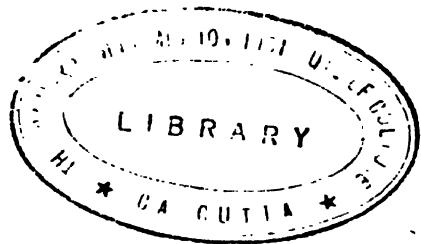


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POSITION-LINE STAR TABLES:
FOR FIXING SHIP'S POSITION
REDUCTION TO MERIDIAN AND PROJECTION VERTICAL
WITHOUT LOGARITHMIC CALCULATION.

*Equally adapted to Marcq St.-Reynaud's
Spherical
Sumner Methods.*

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PREFACE

In the pages which follow is introduced a new **Nautical Astronomy**, which may be called the process of "Reduction to the Prime Vertical." It is intended to do for the longitude problem what is already accomplished for latitude observations near the Meridian, that is, from an observed altitude in the neighbourhood of the Prime Vertical to obtain the hour angle and thence the longitude, by simply applying a correction, without logarithmic aid.

Observations near the Prime Vertical.

From the practical examples worked the reader will readily perceive the analogy between the methods now given and the Ex-Meridian Tables in general use. If any reasons be required for the extension of these methods to the time problem the following points may be noted:—

1. *Simplicity.* The process of computation by means of the Tables is excessively brief and easy to comprehend, and the amount of labour saved is not less than in the case of the Ex-Meridian.

2. *The Range.* For all navigable latitudes the period round the Prime Vertical during which the method is available is a considerable one, not less than two hours when the body is near the Prime Vertical to the eastward, and for a second period of two hours when the bearing is nearly West. In tropical latitudes the method may often be employed whatever the position of the body in its diurnal path. The tables, in fact, acquire wider and wider range as the Equator is approached, so that a ship leaving an English port on a course more or less southerly will find their application more and more extended as the latitude diminishes, whereas in the case of the Ex-Meridian the limits of the Tables are gradually restricted as the Equator is approached.

3. *Adaptation to Finding Position Lines.* The method lends itself with facility to all the Sumner processes in common use,

more particularly to the Marcq Saint-Hilaire method, now adopted generally in the Royal Navy.

4. *The Absence of Interpolation.* The required elements of hour angle and zenith distance being supplied in the Tables for intervals of 20' in latitude, no interpolation can be required so far as latitude is concerned, since whatever the value of the latitude by account it cannot differ by more than 10' from a tabular value. The only interpolation required, therefore, will be that due to a possible small difference of declination, and, as will be shown later, the correction necessary on this account is so simple that it can be practically made at sight.

5. *Occasional use in the case of Planets.* In the collection now presented the Tables have direct reference only to the fixed stars, which, by reason of their nearly constant declination, offer the most favourable conditions for tabulation, but, as explained later, their use may sometimes be extended to the principal planets, when these happen to have declinations approaching values tabulated.

Observations near the Meridian.

An altitude near the Prime Vertical gives a position-line running nearly North and South. For a satisfactory "fix" we must obtain an altitude of a second star not far from the Meridian, which will furnish a position-line nearly East and West. Such an altitude may be reduced to Meridian by means of Table IV., and directions for the use of this Table will be found in the "Explanation and Use of the Tables." Should further information be desired as to the principles of this method, and the manner in which it may be applied to the solution of other nautical problems, the reader is referred to a pamphlet published by Messrs. Griffin and Co.*

The Complete "Fix" in Latitude and Longitude.

By the aid of these Tables the complete "fix" in latitude and longitude can be determined with no more trouble than would be involved in taking out and correcting two more than the usual number of elements from the Nautical Almanac. And it need hardly be pointed out that by the simplicity thus imparted to the operations the risk of error in the result is very materially diminished.

* "A New Table for Solving the Ex-Meridian on Kinematic Principles." By H. B. Goodwin, R.N. Price One Shilling. Griffin and Co., Portsmouth.

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INTRODUCTION.

General formula for change of Zenith Distance in a given interval of Time and deductions therefrom.

If z, z_0 are the Zenith Distances of a heavenly body at the beginning and end of an interval of time Δt

$$z - z_0 = \left(\frac{dz}{dt} \right) \Delta t + \frac{1}{2} \left(\frac{d^2 z}{dt^2} \right) (\Delta t)^2 + \frac{1}{6} \left(\frac{d^3 z}{dt^3} \right) (\Delta t)^3 +$$

where $\frac{dz}{dt} = \cos l \sin A$, l , A being the latitude of place, and Azimuth of body respectively.

From this value of $\frac{dz}{dt}$ it may be deduced that

$$\frac{d^2 z}{dt^2} = \frac{\cos l \cos d \cos \text{PXZ} \cos \text{PZX}}{\sin z}$$

d being the declination of the body, PZX its Azimuth, and PXZ the "Angle of Position" in the fundamental triangle of Nautical Astronomy.

It follows from this expression that the second term on the right hand side of the equation vanishes when the bearing is nearly 90° , i.e., when the body approaches the Prime Vertical, and the expression becomes

$$(z - z_0)'' = 15 \cos l \sin A (\Delta t)^2.$$

terms beyond the second being for the present neglected.

Again, if $\sin A$ may be taken as unity, the value of $(z - z_0)''$ simplifies to $15 \cos l (\Delta t)^2$

So that near the Prime Vertical it results that a body may be regarded as changing its Zenith Distance with a uniform velocity, which is independent of the declination, and depends only upon the latitude of the place.

Application of Principle of Proportion to finding Hour Angle from a given Zenith Distance, and vice versa.

From this uniformity of motion in altitude it follows that if we tabulate for certain conveniently situated bright stars the values of Hour Angles upon the Prime Vertical, and give also the rates of change in Hour Angle per degree of change in Zenith Distance, we have the means of finding the Hour Angle corresponding to a given Zenith Distance by a simple process of proportion. Similarly if we tabulate also the rate of change of

Zenith Distance per unit of time, as for instance per minute, we can find with equal facility the Zenith Distance corresponding to a given Hour Angle.

The Stars selected for tabulation are the following :—

North of Equator.

<i>Star.</i>	<i>Declination.</i>	<i>Star.</i>	<i>Declination.</i>
α Andromedæ	$28^{\circ} 34' N.$	β Leonis...	$15^{\circ} 7' N.$
α Arietis	$23 1 N.$	Arcturus	$19 41 N.$
Aldebaran	$16 19 N.$	α Coronæ	$27 2 N.$
Betelgeuse	$7 23 N.$	Altair	$8 37 N.$
Pollux	$28 15 N.$	Markab	$14 42 N.$
Regulus	$12 26 N.$		

South of Equator.

Rigel	$8 19 S.$	Spica	$10 40 S.$
Sirius	$16 35 S.$	Antares	$26 13 S.$
α Hydræ	$8 15 S.$	Fomalhaut	$30 8 S.$

The following examples will illustrate the facility with which the Tables may be applied to find Hour Angles or Zenith Distance as the case may be.

Example 1.—Betelgeuse has a Zenith Distance of $78^{\circ} 58'$ (West). Required its Hour Angle. Latitude $60^{\circ} N.$ From Table II. (A) :—

Hour Angle on Prime Vertical.	Zenith Distance on Prime Vertical.	Seconds of Time for change per degree of Zenith Distance.
$5^{\text{h}} 42^{\text{m}} 50^{\text{s}}$	$81^{\circ} 28'$	480 ^s

The difference between observed and tabulated Zenith Distances is $2^{\circ} 30'$, or 2.5° . To find difference in Hour Angle we have only to multiply the difference per degree, viz., 480^s, by 2.5, obtaining 1,200 seconds, or 20 minutes. Since, as the star is west of Meridian, the Zenith Distance is increasing, this quantity must be subtracted from the tabulated value of Hour Angle. Thus Hour Angle = $5^{\text{h}} 42^{\text{m}} 50^{\text{s}} - 20^{\text{m}} = 5^{\text{h}} 22^{\text{m}} 50^{\text{s}}$.

Example 2.—Required the Zenith Distance of Aldebaran when the Hour Angle is $3^{\text{h}} 28^{\text{m}} 8^{\text{s}}$ (West). Latitude $30^{\circ} N.$ From Table II. (A) :—

Hour Angle on Prime Vertical.	Zenith Distance on Prime Vertical.	Change of Zenith Distance per minute of Time.
$3^{\text{h}} 58^{\text{m}} 8^{\text{s}}$	$55^{\circ} 48' 45''$	12.99'

Here the westerly Hour Angle, being less than that tabulated, shows the body to be short of Prime Vertical. The Zenith Distance, therefore, is less than that given in the Table.

To find the correction we subtract Hour Angle given, viz., $3^h 28^m 8^s$, from $3^h 58^m 8^s$, obtaining 30^m . Then $12.99' \times 30$, or $389'$ nearly, is the correction.

Subtracting $6^{\circ} 29'$ from $55^{\circ} 48' 45''$, we have $49^{\circ} 19' 45''$, the Zenith Distance required.

The "Second Correction."

So far as we have proceeded, only the first two terms of the series have been taken into account, and, as has been shown, the second term vanishes near the Prime Vertical.

Within a limit of half an hour of the Prime Vertical the third term also, viz., $\frac{1}{6} \frac{d^3 z}{dt^3} (\Delta t)^3$ may be left out of account, but beyond this limit it becomes necessary to take its value into consideration, and if this is done the practicable range in hour angle of the Tables is very greatly extended, and indeed more than doubled in amount.

When the Azimuth is nearly 90° this third term reduces to

$$-\frac{1}{6} \sin^2 1' \sin c \cos^2 c (15 \Delta t)^3$$

where c is the colatitude of place.

The values of the resulting correction are tabulated in Tables II. (B) and II. (C), for finding Hour Angle from Zenith Distance, and Zenith Distance from Hour Angle respectively.

The following example will illustrate the use of this supplementary Table:—

Example 3.—Betelgeuse has a Zenith Distance of $73^{\circ} 28'$ West Required its Hour Angle. Latitude 60° N.

From Table, Zenith Distance = $81^{\circ} 28'$

Observed " " = $73^{\circ} 28'$

Difference 8°

First Correction = $480^s \times 8 = 3840^s = 1^h 4^m 0^s$

Second " = 38^s

Sum of First and Second Corrections ... $1^h 4^m 38^s$

Hour Angle (from Table) $5^{\circ} 42' 50''$

Correction $1^{\circ} 4' 38''$

Hour Angle $4^{\circ} 38' 12''$

Logarithmic calculation gives the value $4^h 38^m 11^s$.

Thus at an Hour Angle more than an hour distant from that of Transit over the Prime Vertical we obtain a result practically identical with that given by rigorous calculation.

Effects of a Change of Declination on the Tabulated Values, and Method of Compensation.

Since the so-called fixed Stars are not absolutely fixed, but are liable to changes of declination, it is necessary to take account of such variations, or in the course of a short time Tables such as these

INTRODUCTION.

would lose their value. Both Hour Angle and Zenith Distance upon Prime Vertical are affected by changes of declination, and the first method which suggests itself would be to give Tables of Corrections to Hour Angle and Zenith Distance per minute of change of declination. The additional trouble involved would, however, seriously affect the value of the Tables as a labour-saving device, particularly when, as in the case of tropical latitudes, the rates of change assume considerable values. If such a method were adopted the form of Table would be somewhat as follows:—

STAR FOMALHAUT (Declination $30^{\circ} 8' S.$).

Latitude.	Hour Angle.	Correction per Minute of Declination.	Zenith Distance.	Correction per Minute of Declination.	Seconds of Time for a Change of one Degree of Zenith Distance.
$37^{\circ} 40'$	$2^h 44^m 58^s$	10.5	$34^{\circ} 45' 45''$	2.5	303.2

Let us suppose that in latitude $37^{\circ} 40' S.$, on July 20th, 1905, when the declination from Nautical Almanac was $30^{\circ} 7' 12'' S.$, the Zenith Distance was $37^{\circ} 45' 45''$. Required the Hour Angle (West).

The work would be as follows:—

$$\text{Correction to Hour Angle} = \frac{4}{5} 10.5^s = 8^s.$$

$$\text{Hour Angle on Prime Vertical} = 2^h 44^m 58^s + 8^s = 2^h 45^m 6^s.$$

$$\text{Correction to Zenith Distance} = \frac{4}{5} 2.5' = 2'.$$

$$\text{Zenith Distance on P.V} = 34^{\circ} 45' 45'' + 2' = 34^{\circ} 47' 45''.$$

$$\text{Observed Zenith Distance} = 37^{\circ} 45' 45''.$$

$$\text{Difference} = 2^{\circ} 58' = 2^{\circ} 97.$$

$$\text{Then } 303.2 \times 2.97 = 900.5 = 15^m.$$

$$\text{And Hour Angle} = 2^h 45^m 6^s + 15^m = 3^h 0^m 6^s.$$

So far as accuracy is concerned, such a method of correction would be satisfactory enough, but it is laborious because it involves the correction of both tabular elements. By means of a modification which has suggested itself to the writer, it has been found possible to attain the same result by means of a single correction applied to the Hour Angle, keeping the tabulated value of Zenith Distance unaltered.

This correction never exceeds six or seven seconds of time per change of one minute in declination, and reduces almost to zero in the tropics, where the separate corrections would give most trouble. Practically the single correction can always be calculated mentally and applied at sight. Moreover there is but one rule as to sign, viz., for increasing declination *add*, decreasing *subtract*.

In this amended form the extract from Table last given would stand :—

Latitude.	Hour Angle.	Correction for change of 1' in Declination.	Zenith Distance.	Seconds of time for change of one degree of Zenith Distance.
37° 40'	2 ^h 44 ^m 58 ^s	2 ^s	34° 45' 45"	303 ^s .2

The work is then as follows :

$$\text{Correction for change of declination} = \frac{1}{6} \text{ of } 2^s = 1.6^s.$$

$$\text{Hour Angle on Prime Vertical} = 2^h 44^m 58^s - 2^s = 2^h 44^m 56^s.$$

$$\text{Difference of Zenith Distance} = 37^{\circ} 45' 45'' - 34^{\circ} 45' 45'' = 3^{\circ}$$

$$\text{And } 303^s.2 \times 3 = 909.6^s = 15^m 10^s.$$

$$\text{Whence } 2^h 44^m 56^s + 15^m 10^s = 3^h 0^m 6^s, \text{ the same result as before.}$$

Limits in Altitudes Tabulated.

The general limits of the Tables are restricted to altitudes from 10° to 60°, i.e., to Zenith Distances from 80° to 30°. Below 10° observations are untrustworthy, while those above 60° are not well adapted to Sumner methods.

Adaptation to position of Maximum Azimuth.

As we pass from high latitudes to the tropics, the Prime Vertical method ceases to be applicable, for the sufficient reason that as soon as the latitude of place becomes less than declination of star, the body will not pass the Prime Vertical at all.

Under this condition, however, i.e., when declination exceeds latitude, both being of same name, at some point in its diurnal path the angle PZX, known as the "Angle of Position," assumes the value of 90°, and when this is the case the uniformity of the velocity in altitude is even more marked than upon the Prime Vertical.

For, reverting for the moment to the expression for $\frac{dz}{dt}$, viz.,

$$\frac{\cos l \cos d \cos PZX \cos PXZ}{\sin z}$$

we see that it vanishes, not only when PZX is 90°, but also when PXZ is 90°, i.e., when the body is at its Maximum Azimuth. Therefore by tabulating the values of Hour Angle and Zenith Distance for Maximum Azimuth also we may extend to low latitudes in the tropics the method applied in the Prime Vertical Tables to places nearer the Pole.

Thus in the case of the two stars Pollux (28° N.) and Betelgeuse (7° N.) the former, which ran out in the Prime Vertical

Table at latitude $32^{\circ} 20'$ N., reappears for Maximum Azimuth at latitude 24° N., and is tabulated down to latitude $4^{\circ} 40'$ N., when the limit of 80° of Zenith Distance is reached.

Thus by one method or other the Hour Angle may be found from altitude of Pollux for a range of about 47 degrees of latitude.

In the second case Betelgeuse runs out of Prime Vertical Table at $8^{\circ} 40'$ N., reappearing for Maximum Azimuth in latitude $6^{\circ} 20'$ N., and continuing to latitude $1^{\circ} 20'$ N. Here, then, we have the star available for 56° of latitude.

The two stars selected being at the extremes of the limits of declination, we may assume therefore that the sum of the zones of latitudes excluded will not be greater than 14° or less than 4° . And the lower the declination of star the more generally available will it be, and the smaller the zone omitted.

The Maximum Azimuth Tables are in some respects simpler in form than those which relate to the Prime Vertical. In the first place the rate of change in seconds of time per degree of Zenith Distance, and of change of Zenith Distance per minute of time, do not depend upon the latitude of place, but upon the declination of star. Thus for a particular star they are constant whatever the latitude. Again, in the case of the Maximum Azimuth, no connection to Hour Angle for a small change of declination is necessary since its value would be inappreciable.

For the First Correction in the case of the Maximum Azimuth we shall have

$$15 \cos d (\Delta t)^8.$$

And for the Second Correction

$$-\frac{1}{6} \sin^2 1' \sin p \cos^2 p (15 \Delta t)^3$$

The same Tables II. (B), II. (C), which serve for the Second Correction in the case of the Prime Vertical, will suffice also for the Maximum Azimuth also, if we remember to enter the Table with declination as argument instead of latitude.

Method of finding what stars are suitable for observation at a particular place and time.

In order to facilitate the process of finding what stars are available near Prime Vertical, Maximum Azimuth, or Meridian, at a particular epoch, four Tables, I. (A), I. (B), I. (C), I. (D) have been computed.

In a given latitude a star will pass Prime Vertical or Meridian at a different instant of Mean Time day by day. But the Sidereal Time of transit is practically constant, and it seems advisable therefore to utilise such Sidereal Time accordingly.

To find Sidereal Time is a simple enough matter, since we have but to add Ship Mean Time to Right Ascension of Mean Sun, as taken from the Nautical Almanac.

As an example of the advantage of such a Table, let us suppose that it is required to find, for August 4th, 1905, what stars will be available near Prime Vertical and Meridian about the period of morning and evening twilight, say about 2^h 30^m a.m. and 9^h 30^m p.m., SMT., in latitude 55° N.

We have R.A. Mean Sun approximately 8^h 50^m. Adding this to 14^h 30^m and 9^h 30^m, we obtain 23^h 20^m and 18^h 20^m respectively. For the passage over Prime Vertical, Table I. (A.) tells us that Aldebaran will bear East at 23^h 18^m Sidereal Time, while in the evening we have Markab East at 17^h 42^m, and Arcturus West at 19^h 13^m. These three stars should therefore be available on the day in question under the advantageous conditions usually attending twilight observations.

With regard to stars near the Meridian various Tables give Mean Time of Transit, but here also the adoption of Sidereal Time supplies a very compact form as in Table I. (D.).

For the value of 23^h 20^m (Sidereal Time), we have Markab, which bears East about 17^h 42^m, on the Meridian about 23^h 0^m, while in the evening Vega passes about 18^h 34^m, and Altair at 19^h 46^m.

Azimuth Tables available for stars tabulated.

Most of the stars fall within the limits of 0° and 24° of declination, and their Azimuths may therefore be taken from the well-known Burdwood and Davis Tables.

The declinations of the following five stars, however, lie without these limits, and their bearings may be found from a collection compiled by the writer:—*

<i>Star.</i>			<i>Declination.</i>
<i>a</i> Andromedæ	...	...	28° 34' N.
Pollux	...	...	28 15 N.
<i>a</i> Coronæ	...	...	27 2 N.
Antares	...	...	26 3 S.
Fomalhaut	...	...	30 8 S.

Extension to the Case of Planets.

As already mentioned the Tables may from time to time be utilised in the case of the principal planets. If the declination of such planet, for instance, falls within about 20' of the value tabulated the correction of hour angle due to the difference of declination for planet and tabulated star will give perfectly trustworthy results.

On the last-mentioned date, viz., August 4th, 1905, it happened that Jupiter had a declination of 19° 44' N., and an observed altitude of this planet might therefore have been dealt with by

* "Azimuth Tables for the Higher Declinations." By H. B. Goodwin. Longmans, Green and Co. Price 7s. 6d.

means of the Tables for Arcturus (Dec. $19^{\circ} 41'$ N.). The declination of the planet remained within $20'$ of that of Arcturus until August 15th. Later in the year, from October 31st to November 29th, the declination of Jupiter again approached the tabulated value for Arcturus. Similarly for Mars. From July 29th to August 3rd the declination lay between $19^{\circ} 21'$ S. and $20^{\circ} 1'$ S., so that here also the values of Arcturus would be available. Later on the declination increased in amount until the values for α Arietis (Dec. $23^{\circ} 1'$ N.) might have been utilised for several days during the later part of August.

So, again, Saturn, on August 4th, had a declination of $12^{\circ} 39'$ S., and the Table for Regulus (Dec. $12^{\circ} 26'$ N.) might have been employed, the declination South having been within $20'$ of that of Regulus North since July 9th.

These, however, may be regarded more or less as coincidences. When, as in the cases mentioned, the planets have declinations approaching those tabulated there is no reason why the Tables should not be turned to practical account. But the principal object which the compiler had in view in the production of these Tables was the simplification of the longitude problem in connection with the altitudes of the fixed stars. Now that year by year such observations are becoming more general in consequence of the increased needs of modern Navigation the effort is perhaps worth making, more particularly as the form of the Tables can be adapted so completely to the Sumner processes in general use.

EXPLANATION AND USE OF TABLES.

TABLES I. (A), I. (B), I. (C), AND I. (D).

Approximate Sidereal Times of Transit over Prime Vertical, Circle of Maximum Azimuth, and Meridian.

TABLES I. (A), I. (B).

These two tables give the approximate Sidereal Time of transit over Prime Vertical for each 5° of latitude from 10° to 60° , East and West. Table I. (A) deals with Northern Stars, and Table I. (B) with Southern.

Arguments, Latitude and Name of star.

TABLE I. (C).

Table I. (C) gives the Sidereal Time of maximum azimuth when declination of star exceeds latitude of place, both being of same name.

Arguments, Latitude and Name of star.

TABLE I. (D).

This Table gives Sidereal Time of Transit over meridian. Such time being independent of latitude, the sole argument is name of star.

To find Sidereal Time at a given instant of Mean Time.

Obtain Greenwich Date by applying longitude in time to given mean time, adding for West, subtracting for East longitude.

Take from Column (p. II. of monthly Ephemeris of Nautical Almanac), headed "Sidereal Time," the Right Ascension of Mean Sun at preceding Greenwich Mean Noon. Correct for hours and minutes of Greenwich Date.

Add R.A. Mean Sun so corrected to given Ship Mean Time.

Example 1.—On March 7th, in latitude 55° N., longitude 43° W., at $6^{\text{h}} 40^{\text{m}}$ p.m., find Sidereal Time, and thence from Tables I. (A), I. (D) what stars are near the Prime Vertical and Meridian respectively.

Greenwich Date.		R.A.M. Sun (at Noon)	$22^{\text{h}} 58^{\text{m}}$	$8^{\text{d}} 2^{\text{m}}$
Ship M.T.	$6^{\text{h}} 40^{\text{m}}$	Corr ^a for 9^{h}	...	$1^{\text{h}} 28^{\text{m}}$
Longitude	$2^{\circ} 52'$	"	32^{m}}...	...
G.D.	$9^{\text{h}} 32'$	Corrected R.A.M. Sun	$22^{\text{h}} 59^{\text{m}}$	$42^{\text{d}} 2^{\text{m}}$
		Ship M.T.	...	$6^{\text{h}} 40^{\text{m}}$ 0
		Sum	$29^{\text{h}} 39^{\text{m}}$	$42^{\text{d}} 2^{\text{m}}$
		Sidereal Time	...	$5^{\text{h}} 39^{\text{m}}$ 42
				B

Thus Sidereal Time is approximately $5^h 40^m$. Entering Table I. (A), with latitude 55° as argument, we find that β Leonis passes Prime Vertical to eastward at $6^h 28^m$ Sidereal Time, while from Table I. (D) it appears that Betelgeuse will pass Meridian at $5^h 50^m$. Both these Stars are therefore available for observation at once, the one for longitude, the other for latitude.

TABLES II. (A), II. (B), AND II. (C).

TABLE II. (A).

In Table II. (A) are given the Hour Angles and Zenith Distances of the Stars selected for tabulation, when in transit over the Prime Vertical.

Arguments, Latitude of place and Name of Star.

The third column gives the correction to tabulated Hour Angle for a small variation of declination. The fifth column has the change of Hour Angle per change of degree in Zenith Distance, for use in finding the Hour Angle corresponding to a given value of Zenith Distance. In the sixth column is given the change of Zenith Distance per minute of time, to be used in finding the Zenith Distance corresponding to a given Hour Angle.

To find the Hour Angle corresponding to a given Zenith Distance.

Take from Table II. (A) the Zenith Distance on Prime Vertical, and find the difference between this and Zenith Distance observed.

Express this difference in degrees and decimals of a degree (N.B. $6' = \frac{1}{10}$ of a degree, and so in proportion.)

From column 5 take the change in seconds of time per degree.

Multiply this by the number of degrees in the difference found above, and apply the quantity resulting to the Hour Angle from Table, corrected if necessary for any change of declination, adding or subtracting according to the circumstances of the case.*

Example 2.—In latitude 55° N., when the Zenith Distance of β Leonis is $74^\circ 40'$, required the Hour Angle (East).

Observed Zenith Distance	...	74°	$40'$	$0''$
Tabular	„	...	71	26

Difference ...	...	...	3	13	45
			$= 3^\circ 23$ nearly		

Correction $= 418^\circ 4 \times 3^\circ 23 = 1351^\circ = 22^m 31^s$.

Hour Angle (from Table)	5°	16^m	23^s (East)
Correction	...	...	22

Corrected Hour Angle	5	38	54 (East)
or	18	21	6

Logarithmic calculation gives $18^h 21^m 4^s$ as the value.

* Since a body increases its altitude continuously up to the meridian, and then diminishes it until it reaches the horizon, a moment's consideration will show whether the correction is additive or subtractive.

To find the Zenith Distance corresponding to a given Hour Angle.

Take from Table II. (A) the Hour Angle of Transit over Prime Vertical, corrected if necessary for any change of declination, and find the difference between this and the Hour Angle given. Express this difference in minutes and decimals of a minute. (N.B.—Six seconds = '1 of a minute, and so in proportion).

Take from Table the change of Zenith Distance per minute of time. Multiply this quantity by the difference obtained above, and apply the product to the Zenith Distance from Table, according to the circumstances of the case.

Example 3.—In latitude 55° N. required the Zenith Distance of β Leonis (Dec. $15^{\circ} 8' 30''$ N.) at an Hour Angle of $5^{\text{h}} 42^{\text{m}} 1^{\text{s}}$ W.

Here the declination is greater by $1' 30''$ than that for which the Table is calculated, viz., $15^{\circ} 7'$ N., and a correction has to be made accordingly. From the third column of Table II. (A) we find that the correction for change of declination is $5^{\text{s}} 6$ per $1'$ change, or $8^{\text{s}} 4$ for $1' 30''$.

Thus the tabular value of Hour Angle, viz., $5^{\text{h}} 16^{\text{m}} 23^{\text{s}}$, becomes $5^{\text{h}} 16^{\text{m}} 31^{\text{s}}$, the correction being additive because declination has increased.

Corrected Hour Angle from Table	...	$5^{\text{h}} 16^{\text{m}} 31^{\text{s}}$
Hour Angle given	...	$5^{\text{h}} 42^{\text{m}} 1^{\text{s}}$
Difference ...	...	$25^{\text{m}} 30^{\text{s}}$
		or $25^{\text{m}} 5$

$$\begin{aligned}\text{Correction in Zenith Distance} &= 8^{\text{s}} 6 \text{ (from Table)} \times 25^{\text{m}} 5 \\ &= 219^{\text{s}} 3 = 3^{\circ} 39' 3.\end{aligned}$$

Correction is additive because body has passed the Prime Vertical, whence

$$\begin{aligned}\text{Zenith Distance} &= 71^{\circ} 26' \text{ (from Table)} + 3^{\circ} 39' 3 \\ &= 75^{\circ} 5' 3.\end{aligned}$$

TABLE II. (B).

Within a range of about half an hour from the Prime Vertical values of the hour angle corresponding to an observed Zenith Distance may be found by means of Table II. (A) in the manner already described, with an amount of error of not more than four seconds of time, the First Correction alone being employed.

Outside this range of half an hour, or within it if a very exact result is required, a Second Correction, tabulated in Table II. (B), is necessary.

Arguments, Latitude and approximate distance in Hour Angle from Prime Vertical.

To find and apply the Second Correction.

Enter Table II. (B) with approximate latitude and distance in Hour Angle from Prime Vertical.

Add quantity from Table to First Correction, and apply the sum to tabular Hour Angle.

Example 4.—In Example 2, given above, in latitude 55° , when the Zenith Distance of β Leonis is $74^{\circ} 40'$, required the *exact* Hour Angle (East).

From work already given, First Correction is found to be $22^{\text{m}} 31^{\text{s}}$.

Entering Table II. (B) with this value as distance from Prime Vertical, and with 55° as latitude, we find the Second Correction to be approximately 2 seconds.

Thus, sum of First and Second Corrections is $22^{\text{m}} 33^{\text{s}}$.

Then, Hour Angle (from Table) $5^{\text{h}} 16^{\text{m}} 23^{\text{s}}$ (East)

Sum of Corrections $22^{\text{m}} 33^{\text{s}}$

Sum $5^{\text{h}} 38^{\text{m}} 56^{\text{s}}$ (East)
or, $18^{\text{m}} 21^{\text{s}}$

which agrees exactly with the result by logarithmic calculation.

TABLE II. (C).

This Table is for use in calculating Zenith Distance corresponding to a given Hour Angle, giving the Second Correction, always subtractive from the First Correction, to be applied to the tabular Zenith Distance.

Arguments, Latitude and approximate distance in Hour Angle from Prime Vertical.

To find and apply the Second Correction.

Enter Table II. (C.) with approximate Latitude and distance in Hour Angle from Prime Vertical. Subtract the quantity taken from Table from the First Correction, and apply this difference to the tabular zenith distance according to the circumstances of the case.

Example 5.—In Latitude 50° N. required the Zenith Distance of Aldebaran, when its Hour Angle is $6^{\text{h}} 7^{\text{m}} 37^{\text{s}}$ (West), the declination being $16^{\circ} 24'$ N.

The declination of star having increased by $5'$ from the tabular value $16^{\circ} 19'$ N. we have to apply a correction of $4^{\text{s}} 6 \times 5$, or 23^{s} , to the tabular Hour Angle $5^{\text{h}} 3^{\text{m}} 7^{\text{s}}$, which becomes, therefore, $5^{\text{h}} 3^{\text{m}} 30^{\text{s}}$.

Then Hour Angle given... $6^{\text{h}} 7^{\text{m}} 37^{\text{s}}$
 Tabular Hour Angle $5^{\text{h}} 3^{\text{m}} 30^{\text{s}}$

Difference $1^{\text{h}} 4^{\text{m}} 7^{\text{s}}$

First Correction = $9^{\text{s}} 64 \times 64^{\text{s}} 1 = 10^{\circ} 17^{\text{s}} 9$.

From Table II. (C.).—Second Correction (for Latitude 50° , Distance in Hour Angle 65^{m}) is $4^{\text{s}} 9$.

Tabular Zenith Distance $68^{\circ} 29' 0''$

Difference of First and Second Corrections $10^{\text{s}} 13^{\text{s}} 0^{\text{s}}$

Sum $78^{\text{s}} 42^{\text{s}} 0^{\text{s}}$

This result, differing by only about '5' from that given by rigorous calculation, illustrates the reliability of the method, since the Hour Angle is more than an hour distant from that of transit over the Prime Vertical, and the declination of star differs by as much as 5' from that used in calculating the Tables.

TABLE III.

In Table III. are given the Hour Angles and Zenith Distances corresponding to the position of Maximum Azimuth, when the "Angle of Position" is 90°.

That this may be the case the declination of the body must be greater than the latitude of place, so that the Table is concerned only with latitudes within the tropics, or just outside their limits.

In the case of the Maximum Azimuth the effect of a small change of declination being inappreciable, no column of corrections corresponding to the third column of Table II. (A) is required.

Moreover, since the rates of change in Hour Angle for a degree of Zenith Distance, and of Zenith Distance per minute of time, are constant for a particular star, columns 5 and 6 of Table II. (A) may be dispensed with, the necessary rates for the star in question being given at the head of the Tables relating to that star.

To find the Hour Angle corresponding to a given Zenith Distance near the position of Maximum Azimuth.

Take from the Table the Zenith Distance at Maximum Azimuth, and find the difference between this and the Zenith Distance observed.

Express this in degrees and decimals of a degree (N.B.—6' = 1 of a degree, and so in proportion).

Take from the head of Table the seconds of time corresponding to a degree of Zenith Distance.

Multiply this number by the value of the difference found above, and apply the product to the Hour Angle from Table according to circumstances.

Example 6.—In latitude 12° 40' N. required the Hour Angle of Arcturus, when the Zenith Distance is 54° 30' (East).

Observed Zenith Distance	...	...	54°	30'	
Tabular	„	„	...	49	23
Difference	...	...	5	7	
					= 5.12°
Correction = 254.9 ^s × 5.12 = 1305 ^s					
Hour Angle East (from Table)...	3 ^h	24 ^m	19 ^s		
Correction ...	...	...	21	45	
Sum ...	...	...	3	46	4 (East)
	24				
Hour Angle required	20 ^h	13 ^m	56 ^s		

Note.—In the case of the Maximum Azimuth the Second Correction will only be required in exceptional cases, when the distance from the position of Maximum Azimuth is considerable. When made use of it is taken from Table II. (B) in the manner already described, and added to the First Correction, the argument declination of star being substituted for latitude of place.

To find the Zenith Distance corresponding to a given Hour Angle near the position of Maximum Azimuth.

Take from Table the Hour Angle for Maximum Azimuth, and find the difference between this and the given Hour Angle.

Express the difference in minutes and decimals of a minute.

Take from head of Table the change of Zenith Distance per minute of time. Multiply this quantity by the number of minutes obtained above, and apply the product to the tabulated Zenith Distance, according to circumstances.

Example 7.—In latitude 7° N. required the Zenith Distance of Altair at an Hour Angle of $3^{\text{h}} 5^{\text{m}}$ (West).

Hour Angle given...	...	...	...	$3^{\text{h}} 5^{\text{m}} 0^{\text{s}}$
",", from Table	...	...	...	$2^{\text{h}} 23^{\text{m}} 30^{\text{s}}$
				<hr/>
				41 30
			or	41.5 ^m
Correction = $14.83'$ (from Table)	$\times 41.5$			$10^{\circ} 15.4'$
	$= 615.4$	$=$		
Zenith Distance from Table ...	...			$35^{\circ} 34'$
Correction ...	...	...	...	$10 15.4$
			<hr/>	
Zenith Distance required ...	...	...		45 49.4

TABLE IV.

As is pointed out in the preface, this Table is not a new one, but was published in pamphlet form by Messrs. Griffin in 1903. Its primary object is to reduce to the Meridian an altitude taken on a small bearing, but it can be employed with equal facility in obtaining the Zenith Distance of a body which lies within the ex-Meridian limits of Azimuth. With latitude of place and Azimuth of body as arguments the Table gives the rate of change of altitude per minute of time and the "Reduction to the Meridian" is found in the following manner:—

To find the "Reduction to the Meridian," and thence the latitude by Table IV.

With approximate latitude of place, declination of body, and half Hour Angle as arguments, take out from the Azimuth Tables the approximate Azimuth.

With this Azimuth and latitude of place as arguments, take out "rate of change."

Multiply this rate by the number of minutes of time in the whole Hour Angle to obtain "Reduction."

Apply the "Reduction" to observed Zenith Distance, in order to obtain Meridian Zenith Distance, whence latitude is derived by the ordinary rules.

Example 8.—In latitude 55° N. the Zenith Distance of Betelgeuse (declination $7^{\circ} 23'$ N.) was $47^{\circ} 44'$, when the Hour Angle was 16^m (West). Find the "Reduction to the Meridian," and thence the true latitude.

From Burdwood, for latitude 55° N., declination 7° N., one half Hour Angle 8^m , the Azimuth is approximately $2^{\circ} 40'$.

From Table IV., for latitude 55° , Azimuth $2^{\circ} 40'$, the "rate of change" is $4'$ (nearly).

Whence

$$\text{"Reduction"} = 4' \times 16, = 64'$$

And Meridian Zenith Distance $= 47^{\circ} 44' - 64' = 47^{\circ} 37.6'$.

So that

$$\text{Latitude} = 47^{\circ} 37.6' + 7^{\circ} 23' = 55^{\circ} 0.6' \text{ N.}$$

Having given latitude of place, declination of body, and Hour Angle, to find the Zenith Distance, the body being not far from Meridian at the time.

With the given latitude, and declination of body, take from the Tables the Azimuth corresponding to *half* the Hour Angle.

With this Azimuth and the given latitude take out the "rate of change" from Table IV.

Multiply this rate by the minutes in the whole Hour Angle, and we have the "Reduction."

With the given latitude and declination compute Meridian Zenith Distance.

Add "Reduction" found above to this Meridian Zenith Distance. The sum is Zenith Distance required.

Example 9.—In latitude $41^{\circ} 20'$ N. required the Zenith Distance of Sirius (Dec. $16^{\circ} 35'$ S.) at an Hour Angle of 22^m (West).

From Burdwood for latitude $41^{\circ} 20'$ N., Declination $16\frac{1}{2}^{\circ}$ (contrary name), *half* Hour Angle 11^m , the Azimuth is 3° nearly.

From Table IV., "rate of change" for latitude $41^{\circ} 20'$ N., Azimuth 3° , is $59'$.

$$\text{"Reduction"} = 59' \times 22 = 13' \text{ nearly.}$$

And Meridian Zenith Distance $= 41^{\circ} 20' + 16^{\circ} 35' = 57^{\circ} 55'$.

Thus Zenith Distance required $= 57^{\circ} 55' + 13' = 58^{\circ} 8'$.

The Complete Solution for Latitude and Longitude by means of the Tables.

The following example will perhaps serve to illustrate the manner in which a complete "fix" may be obtained by means of a pair of suitably chosen stars.

Example 10.—On April 24th, 1905, at $10^h 20^m$ p.m. (Ship M.T. nearly) in latitude 55° N., longitude $6^{\circ} 20'$ W., the true Zenith

Distance of Pollux, near the Prime Vertical (West) was $57^{\circ} 18'$, at $10^{\text{h}} 45^{\text{m}} 42^{\text{s}}$ G.M.T.

And at $10^{\text{h}} 35^{\text{m}}$ (Ship M.T.), when G.M.T. was $11^{\text{h}} 0^{\text{m}} 42^{\text{s}}$, the true Zenith Distance of Spica was $66^{\circ} 16'$. Required the position of ship.

To find the longitude corresponding to latitude 55° N. from Zenith Distance of Pollux.

			From Nautical Almanac.		
G.D.	R.A.M. Sun.	R.A. Pollux	...	7 ^h 39 ^m 30 ^s	
$10^{\text{h}} 45^{\text{m}} 42^{\text{s}}$	$2^{\text{h}} 7^{\text{m}} 22^{\text{s}}$	Dec. , ,	28 ^o 15' N.		
	1 38.5	R.A. Spica	...	13 ^h 20 ^m 11 ^s	
	7.4	Dec. , ,	10 ^o 40' S.		
	1				
	2 9 8				

Observed Zenith Distance Pollux	...	57 ^o 18' 0"
Zenith Distance (from Table)	...	54 42 15

$$\begin{array}{r} \text{Difference} \dots \dots 2 35 45 \\ = 2.6^{\circ} \text{ (nearly)} \\ \text{Correction to Hour Angle} = 418.4^{\circ} \times 2.6 = 1087.8^{\circ} \\ = 18^{\text{m}} 8^{\text{s}} \end{array}$$

Hour Angle (from Table)	...	...	4 ^h 31 ^m 36 ^s
Correction	...	...	18 8
Hour Angle of Star	...	...	4 49 44
R.A. of Star	...	...	7 39 30
Sidereal Time	...	...	12 29 14
R.A.M. Sun	...	...	2 9 8
Ship M.T.	...	...	10 20 6
G.M.T.	...	...	10 45 42
Longitude	...	...	25 36

Or $6^{\circ} 24'$ W.

Next, to determine Latitude from Zenith Distance of Spica.

Ship M.T. (from Hour Angle of Pollux)	$10^{\text{h}} 20^{\text{m}} 6^{\text{s}}$
Interval between observations	15 0

Ship M.T. of Second observation	.. 10 35 6
R.A. Mean Sun	.. 2 9 10
Sidereal Time	.. 12 44 16
R.A. Star	.. 13 20 11

Hour Angle of Spica	23 24 5
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From Burdwood, for latitude 55° , Declination $10^{\circ} 40'$ (different names) and half Hour Angle 18^{m} (East), the Azimuth is 5° (nearly).

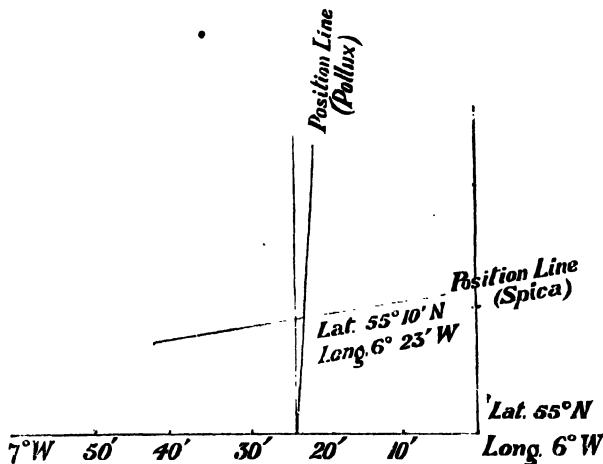
From Table IV., for latitude 55° , Azimuth 5° , the "rate of change" is $.75'$.

Whence "Reduction" = $.75' \times 36 = 27'$.

Thus Meridian Zenith Distance = $66^{\circ} 16' - 27' = 65^{\circ} 49'$, and latitude = $65^{\circ} 49' - 10^{\circ} 40' = 55^{\circ} 9' N.$

For the Azimuth of Pollux we have from Goodwin's Azimuth Tables, for latitude 55° , Declination 28° (same name), altitude 33° , the bearing N. 87° W.

While from Burdwood for latitude 55° N., Declination $10^{\circ} 40'$ (different names) Hour Angle 36^m (East) the bearing is S. 10° E.



Laying off position lines in accordance with these data we find the true position to be in latitude $55^{\circ} 10'$ N., longitude $6^{\circ} 23'$ W.

*The same example worked by the Marcy Saint-Hilaire process.
To calculate the Zenith Distance of Pollux.*

G.M.T. ....	...	...	...	...	10 ^h 45 ^m 42 ^s
Longitude	•	...	...	...	25 20
Ship M.T.	...	...	...	...	10 20 22
R.A.M. Sun	...	...	...	...	2 9 8
Sidereal Time	...	...	...	...	12 29 30
R.A. Star	...	...	...	...	7 39 30
H.A. Star	...	...	...	...	4 50 0
From Table II. (A) (lat. 55°) Hour Angle					4 ^h 31 ^m 36
H.A. at time of observation	...	...	...	...	4 50 0
Difference	...	...	...	...	18 24
					= 18.4 ^m

Change of Zenith Distance in interval = $8.6' \times 18.4 = 158.24'$
 $= 2^{\circ} 38' 15''$

Zenith Distance on P.V.
 (from Table) $54^{\circ} 42' 15''$
 Change in interval 2 38 15

Calculated Zenith Distance	57	20	30	
Observed • ,	...	57	18	0
Difference	...	2	30	(Zenith nearer to Pollux)

To calculate the Zenith Distance of Spica.

G.M.T. ...	...	...	...	...	11 ^h 0 ^m 42 ^s
Longitude	...	...	...	...	25 20
Ship M.T.	...	...	...	10 35 22	
R.A.M. Sun	...	...	...	2 9 10	
Sidereal Time	...	...	...	12 44 32	
R.A. Star	...	...	...	13 20 11	
Hour Angle Star	...	...	...	23 24 21	

From above, Azimuth for Half-hour Angle is S. 5° E.

Assumed latitude 55° 0' N.

Declination... 10 40 S.

Meridian Zenith Distance 65 40

From Table IV. "rate of change" is .75.

And "Reduction" = .75' × 35.6.

$$= 26'7.$$

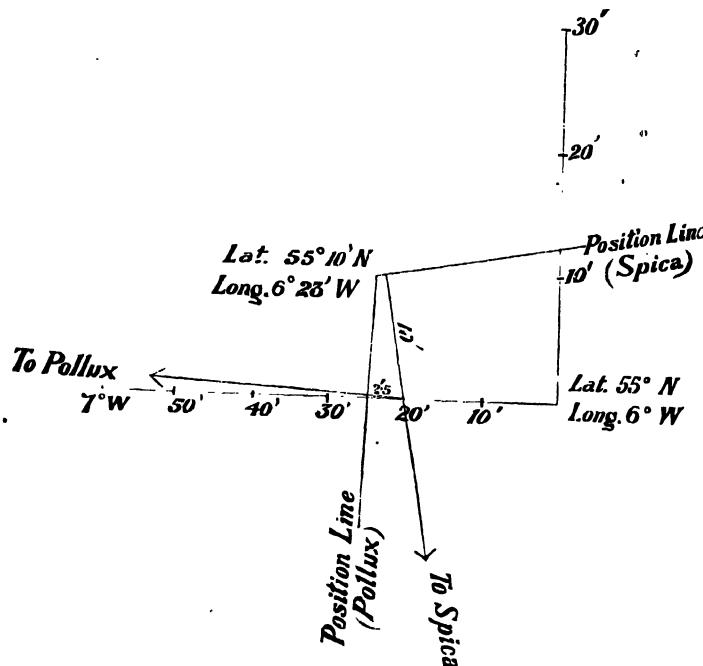
Whence Zenith Distance = 65° 40' + 26'7.

$$= 66° 7' \text{ (nearly).}$$

Observed Zenith Distance 66° 17'

Calculated " " " 66 7

And difference is 10', Zenith being further from Spica than supposed.



If we proceed to lay off lines upon a Chart in accordance with the bearings of the two stars, and draw position-lines at right angles to these lines through the points indicated by the differences obtained above, the position-lines will be found to intersect as before in latitude 55° 10' N., longitude 6° 23' W.

TABLES
I. (A), I. (B), I. (C), AND I. (D).

APPROXIMATE SIDEREAL TIMES OF
TRANSIT

(For Prime Vertical, Circle of Maximum
Azimuth, and Meridian).

TABLE I. (A.).

APPROXIMATE SIDEREAL TIME AT WHICH STARS PASS THE PRIME VERTICAL IN NORTH LATITUDE.

STAR.	LATITUDE.									
	60°		55°		50°		45°		40°	
	E.	W.	E.	W.	E.	W.	E.	W.	E.	W.
Andromedæ	19 17	4 50	19 33	4 34	19 52	4 15	20 15	3 52	20 45	3 22
Arietis	20 59	7 5	21 11	6 53	21 25	6 38	21 42	6 21	22 3	6 0
Aldebaran	23 9	9 51	23 18	9 43	23 27	9 34	23 39	9 22	23 52	9 9
Betelgeuse	0 7	11 33	0 11	11 29	0 15	11 25	0 20	11 20	0 26	11 14
Pollux	2 52	12 27	3 8	12 11	3 27	11 52	3 49	11 30	4 19	11 0
Regulus	4 33	15 34	4 39	15 28	4 46	15 21	4 54	15 12	5 4	15 2
β Leonis	6 20	17 8	6 28	17 1	6 37	16 52	6 47	16 42	6 57	16 32
Arcturus	8 59	19 24	9 9	19 13	9 21	19 1	9 35	18 47	9 52	18 30
Coronaæ	10 39	20 22	10 54	20 7	11 12	19 49	11 33	19 28	12 0	19 1
Altair	14 6	1 26	14 11	1 22	14 15	1 17	14 21	1 11	14 28	1 5
Markab	17 35	4 25	17 42	4 18	17 51	4 9	18 1	3 59	18 13	3 47

STAR.	LATITUDE.									
	35°		30°		25°		20°		15°	
	E.	W.	E.	W.	E.	W.	E.	W.	E.	W.
Andromedæ	21 28	2 39	h m	h m	h m	h m	h m	h m	h m	h m
Arietis	22 31	5 32	23 11	4 52	h m	h m	h m	h m	h m	h m
Aldebaran	0 9	8 52	0 32	8 29	1 6	7 55	2 5	6 56	h m	h m
Betelgeuse	0 33	11 7	0 42	10 58	0 55	10 45	1 13	10 27	1 46	9 54
Pollux	5 0	10 19	5 33	14 34	5 56	14 10	6 32	13 34	7 45	12 22
Regulus	5 17	14 50	5 33	14 34	5 56	14 10	6 32	13 34	7 45	12 22
β Leonis	7 15	16 13	7 36	15 53	8 6	15 23	8 56	14 33	h m	h m
Arcturus	10 14	18 8	10 44	17 38	11 32	16 51	h m	h m	h m	h m
Coronaæ	12 38	18 24	h m	h m	h m	h m	h m	h m	h m	h m
Altair	14 36	0 56	14 47	0 45	15 2	0 30	15 25	0 8	16 4	23 28
Markab	18 28	3 32	18 48	3 12	19 17	2 43	20 5	1 56	17 43	21 49

TABLE I. (B.)

APPROXIMATE SIDEREAL TIME AT WHICH STARS PASS THE
PRIME VERTICAL IN SOUTH LATITUDE.

STAR.	LATITUDE.									
	60°		55°		50°		45°		40°	
	E.	W.	E.	W.	E.	W.	E.	W.	E.	W.
Rigel	23 29	10 50	23 33	10 46	23 38	10 42	23 43	10 36	23 50	10 30
Sirius	1 21	12 1	1 29	11 53	1 39	11 43	1 50	11 32	2 4	11 18
α Hydrie	3 42	15 4	3 46	15 0	3 51	14 55	3 56	14 50	4 3	14 43
Spica	7 45	18 55	7 51	18 50	7 57	18 44	8 4	18 37	8 12	18 28
Antares	11 30	21 18	11 44	21 3	12 1	20 46	12 22	20 26	12 47	20 0
Fomalhaut	18 11	3 34	18 28	3 16	18 49	2 56	19 14	2 30	19 47	1 57

TABLE I. (C.)

APPROXIMATE SIDEREAL TIME OF MAXIMUM AZIMUTH
(ANGLE OF POSITION = 90°).

IN NORTH LATITUDE.

STAR.	20°		15°		10°		5°	
	E.	W.	E.	W.	E.	W.	E.	W.
α Andromedæ	20 51	3 15	20 1	4 5	19 19	4 47	18 40	5 26
α Arietis	...	...	22 38	5 26	21 40	6 24	20 50	7 14
Aldebaran	...	...			0 58	8 2	23 40	9 20
Betelgeuse	...	...					2 40	9 0
Pollux	...	...	4 30	10 48	3 39	11 39	2 56	12 22
Regulus	...	...					7 35	12 31
β Leonis	...	...					8 27	15 1
Arcturus	...	...					7 0	16 28
α Coronæ	...	...	12 33	18 29	12 38	19 24	10 52	20 10
Altair	...	...	•				10 10	20 52
Markab	...	...					16 7	23 25
							18 18	3 42

IN SOUTH LATITUDE.

STAR.	20°		15°		10°		5°	
	E.	W.	E.	W.	E.	W.	E.	W.
Rigel					1 37	8 43
Sirius			3 6	10 16	1 49	11 33
α Hydræ					5 51	12 55
Spica					9 11	17 29
Antares	13 35	19 13	12 36	20 12	11 48	21 0
Fomalhaut	19 27	2 17	18 42	3 2	18 3	3 41
							17 27	4 17

TABLE I. (D.)

APPROXIMATE SIDEREAL TIME OF TRANSIT OF
PRINCIPAL STARS OVER MERIDIAN.

STAR.	Declination.	Sidereal Time of Transit.
α Andromedæ 28 35 N. 0 4		
Polaris 88 49 N. 1 26		
α Arietis 23 1 N. 2 2		
Aldebaran 16 19 N. 4 31		
Capella 45 54 N. 5 10		
Rigel 8 19 S. 5 10		
γ Orionis 6 16 N. 5 20		
Betelgeuse 7 23 N. 5 50		
Canopus 52 39 S. 6 22		
Sirius 16 35 S. 6 41		
Castor 32 6 N. 7 29		
Procyon 5 28 N. 7 34		
Pollux 28 15 N. 7 40		
α Hydræ 8 15 S. 9 23		
Regulus 12 25 N. 10 3		
β Leonis 15 6 N. 11 44		
Spica 10 41 S. 13 20		
Arcturus 19 20 N. 14 11		
α Coronæ 27 2 N. 15 31		
Antares 26 14 S. 16 24		
Vega 38 42 N. 18 34		
Altair 8 37 N. 19 46		
Fomalhaut 30 7 S. 22 53		
Markab 14 42 N. 23 0		

TABLE II. (A).

HOUR ANGLES AND ZENITH DISTANCES
ON
PRIME VERTICAL

(For Finding First, or Principal, Correction).

LIMIT OF LATITUDE 60° . APPROXIMATE LIMITS OF
ZENITH DISTANCE 30° TO 80° .

TABLE II. (A.)
ELEMENTS UPON PRIME VERTICAL.

α ANDROMEDA (DECLINATION $28^{\circ} 34' N.$)

LATITUDE, 60° N. to 33° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
60 0	4 46 43	6.6	56 29 0	480	7.50
59 40	45 41	6.5	21 30	475.2	7.58
20	44 40	6.4	13 30	470.5	7.65
0	43 37	6.3	5 30	466.0	7.73
58 40	42 34	6.2	55 57 15	461.5	7.80
20	41 30	6.1	49 0	457.2	7.87
0	40 26	6.0	40 30	452.9	7.95
57 40	39 22	5.9	32 0	448.7	8.02
20	38 16	5.8	23 15	444.7	8.10
0	37 10	5.8	14 15	440.7	8.17
56 40	36 4	5.7	5 15	436.8	8.24
20	34 57	5.6	54 56 0	432.9	8.32
0	33 49	5.5	46 30	429.2	8.39
55 40	32 41	5.4	37 0	425.5	8.46
20	31 31	5.4	27 0	421.9	8.53
0	30 22	5.3	17 0	418.4	8.60
54 40	29 11	5.2	7 0	415.0	8.68
20	28 0	5.1	53 56 30	411.6	8.75
0	26 48	5.1	46 0	408.3	8.82
53 40	25 35	5.0	35 15	405.1	8.89
20	24 21	4.9	24 30	401.9	8.96
0	23 7	4.8	13 15	398.7	9.03
52 40	21 51	4.8	1 45	395.7	9.10
20	20 35	4.7	52 50 15	392.8	9.17
0	19 18	4.6	38 30	389.8	9.23
51 40	18 0	4.6	26 15	386.9	9.30
20	16 41	4.5	14 0	384.1	9.37
0	15 21	4.4	1 30	381.4	9.44
50 40	14 1	4.4	51 48 45	378.6	9.51
20	12 39	4.3	35 45	376.0	9.57
0	11 16	4.2	22 30	373.4	9.64
49 40	9 52	4.2	9 0	370.8	9.71
20	8 27	4.1	50 55 15	368.5	9.77
0	7 0	4.1	41 0	365.8	9.84
48 40	5 33	4.0	26 45	363.4	9.91
20	4 44	4.0	12 0	361.0	9.97
0	2 35	3.9	49 57 0	358.7	10.04

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.
(c) For use in finding Zenith Distance from Hour Angle.

(b) For use in finding

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

a ANDROMEDA (DECLINATION 28° 34' N.).—Continued.

LATITUDE, 60° N. to 33° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
47 40	4 1 3	3·8	49 41 45	356·4	10·10
20	3 59 31	3·8	26 0	354·1	10·17
0	57 57	3·7	10 15	351·9	10·23
46 40	56 22	3·6	48 53 45	349·7	10·29
20	54 45	3·6	37 15	347·6	10·36
0	53 7	3·5	20 15	345·5	10·42
45 40	51 27	3·5	2 45	343·4	10·48
20	49 46	3·4	47 45 0	341·4	10·54
0	48 3	3·3	27 0	339·4	10·61
44 40	46 18	3·3	8 30	337·5	10·67
20	44 32	3·2	46 49 15	335·5	10·73
0	42 43	3·2	30 0	333·6	10·79
43 40	40 53	3·1	10 0	331·8	10·85
20	39 1	3·1	45 49 45	330·0	10·91
0	37 7	3·0	28 45	328·2	10·97
42 40	35 10	3·0	7 30	326·4	11·03
20	33 11	2·9	44 45 45	324·7	11·09
0	31 10	2·9	23 15	323·0	11·15
41 40	29 7	2·8	0 15	321·3	11·21
20	27 1	2·7	43 36 45	319·6	11·26
0	24 53	2·7	12 30	318·0	11·32
40 40	22 42	2·7	42 47 45	316·4	11·38
20	20 28	2·6	22 15	314·8	11·44
0	18 11	2·6	41 56 0	313·3	11·49
39 40	15 50	2·5	29 0	311·8	11·55
20	13 27	2·5	1 30	310·3	11·60
0	11 0	2·4	40 33 0	308·8	11·66
38 40	8 30	2·4	3 45	307·4	11·71
20	5 56	2·3	39 33 30	306·0	11·77
0	3 17	2·2	2 30	304·6	11·82
37 40	0 35	2·2	38 30 30	303·2	11·87
20	2 57 48	2·1	37 57 15	301·8	11·93
0	54 57	2·1	23 15	300·5	11·98
36 40	52 0	2·0	36 47 45	299·2	12·03
20	48 58	2·0	11 15	297·9	12·08
0	45 51	2·0	35 33 30	296·7	12·14
35 40	42 38	1·9	34 54 15	295·4	12·19
20	39 18	1·8	13 30	294·2	12·24
0	35 51	1·8	33 31 15	293·0	12·29
34 40	32 16	1·7	32 47 15	291·8	12·34
20	28 34	1·6	1 30	290·6	12·39
0	24 42	1·6	31 13 30	289·5	12·44
33 40	20 41	1·5	30 23 30	288·4	12·48

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.

(b) For use in finding
(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL

α ARIETIS (DECLINATION 23° 1' N.)						
LATITUDE, 60° N. to 27° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)	
° /	h m s	s.	° / "	s.		
60 0	5 3 15	6·7	63 9 45	480·0	7·50	
59 40	2 26	6·6	3 45	475·2	7·58	
20	1 38	6·5	62 57 45	470·5	7·65	
0	0 51	6·4	51 45	466·0	7·73	
58 40	0 2	6·3	45 30	461·5	7·80	
20	4 59 14	6·3	39 0	457·2	7·87	
0	58 25	6·2	32 45	452·9	7·95	
57 40	57 36	6·1	26 15	448·7	8·02	
20	56 47	6·0	19 30	444·7	8·10	
0	55 57	5·9	12 45	440·7	8·17	
56 40	55 6	5·8	5 45	436·8	8·24	
20	54 15	5·8	61 58 45	432·9	8·32	
0	53 24	5·7	51 15	429·2	8·39	
55 40	52 32	5·6	44 15	425·5	8·46	
20	51 40	5·5	37 0	421·9	8·53	
0	50 47	5·5	29 15	418·4	8·60	
54 40	49 53	5·4	21 45	415·0	8·68	
20	49 0	5·3	14 0	411·6	8·75	
0	48 5	5·2	6 0	408·3	8·82	
53 40	47 10	5·1	60 57 45	405·1	8·89	
20	46 15	5·1	49 30	401·9	8·96	
0	45 19	5·0	41 15	398·7	9·03	
52 40	44 23	5·0	32 45	395·7	9·10	
20	43 25	4·9	24 0	392·8	9·17	
0	42 28	4·8	15 15	389·8	9·23	
51 40	41 29	4·8	6 0	386·9	9·30	
20	40 30	4·7	59 57 0	384·1	9·37	
0	39 31	4·6	47 30	381·4	9·44	
50 40	38 31	4·6	38 0	378·6	9·51	
20	37 30	4·6	28 30	376·0	9·57	
0	36 28	4·5	18 30	373·4	9·64	
49 40	35 26	4·4	8 30	370·8	9·71	
20	34 23	4·3	58 58 15	369·3	9·77	
0	33 19	4·3	47 45	365·8	9·84	
48 40	32 14	4·2	37 15	363·4	9·91	
20	31 9	4·2	26 15	361·0	9·97	
0	30 3	4·1	15 15	358·7	10·04	
47 40	28 56	4·1	4 0	356·4	10·10	
20	27 48	4·0	57 52 30	354·1	10·17	
0	26 39	3·9	41 0	351·9	10·23	
46 40	25 29	3·9	29 0	349·7	10·29	
20	24 19	3·8	16 45	347·6	10·36	
0	23 7	3·8	4 30	345·5	10·42	

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

a ARIETIS (DECLINATION 23° 1' N.)—Continued.

LATITUDE, 60° N. to 27° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
45 40	4 21 55	3.8	56 51 45	343.4	10.48
20	20 41	3.7	39 0	341.4	10.54
0	19 27	3.6	25 45	339.4	10.61
44 40	18 11	3.6	12 30	337.5	10.67
20	16 54	3.6	55 58 45	335.5	10.73
0	15 36	3.5	44 45	333.6	10.79
43 40	14 17	3.4	30 30	331.8	10.85
20	12 57	3.4	16 0	330.0	10.91
0	11 36	3.3	1 0	328.2	10.97
42 40	10 13	3.3	54 45 45	326.4	11.03
20	8 49	3.2	30 30	324.7	11.09
0	7 24	3.2	14 30	323.0	11.15
41 40	5 57	3.1	53 58 30	321.3	11.21
20	4 29	3.1	42 0	319.6	11.26
0	2 59	3.0	25 0	318.0	11.32
40 40	1 27	3.0	7 45	316.4	11.38
20	3 59 55	2.9	52 50 0	314.8	11.44
0	58 20	2.9	32 0	313.3	11.49
39 40	56 44	2.8	13 30	311.8	11.55
20	55 6	2.8	51 54 45	310.3	11.60
0	53 26	2.7	35 15	308.8	11.66
38 40	51 44	2.7	15 30	307.4	11.71
20	50 0	2.7	50 55 15	306.0	11.77
0	48 15	2.6	34 30	304.6	11.82
37 40	46 27	2.6	13 0	303.2	11.87
20	44 37	2.5	49 51 15	301.8	11.93
0	42 44	2.5	28 45	300.5	11.98
36 40	40 49	2.4	6 0	299.2	12.03
20	38 52	2.4	48 42 15	297.9	12.08
0	36 52	2.3	18 0	296.7	12.14
35 40	34 50	2.3	47 53 0	295.4	12.19
20	32 44	2.3	27 45	294.2	12.24
0	30 35	2.2	1 30	293.0	12.29
34 40	28 24	2.2	46 34 30	291.8	12.34
20	26 9	2.1	6 45	290.6	12.39
0	23 51	2.1	45 38 15	289.5	12.44
33 40	21 29	2.1	8 45	288.4	12.48
20	19 4	2.0	44 38 15	287.3	12.53
0	16 35	2.0	7 0	286.2	12.58
32 40	14 1	2.0	43 34 45	285.1	12.63
20	11 23	1.9	1 30	284.0	12.67
0	8 40	1.9	42 27 0	283.0	12.72

(a) Increased Declination add.
Hour Angle from Zenith Distance

Decreased Declination subtract.

(c) For use in finding Zenith Distance from Hour Angle.

(b) For use in finding

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

α ARIETIS (DECLINATION 23° 1' N.)—Continued.

LATITUDE, 60° N. to 27° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
0°	h m s	s.	° ' "	s.	
31 40	3 5 53	1·8	41 51 30	282·0	12·77
20	3 0	1·8	14 45	281·0	12·81
0	0 2	1·7	40 36 30	280·0	12·86
30 40	2 56 58	1·7	39 57 0	279·0	12·90
20	53 47	1·6	16 0	278·1	12·95
0	50 30	1·6	38 33 15	277·1	12·99
29 40	47 5	1·5	37 49 0	276·2	13·03
20	43 33	1·5	2 45	275·3	13·08
0	39 53	1·4	36 14 30	274·4	13·12
28 40	36 3	1·4	35 24 15	273·5	13·16
20	32 3	1·3	34 31 45	272·7	13·20
0	27 52	1·3	33 36 30	271·9	13·24
27 40	23 30	1·2	32 38 30	271·0	13·28
20	18 54	1·2	31 37 15	270·2	13·33
0	14 3	1·1	30 32 30	269·4	13·37

ALDERARAN (DECLINATION 16° 19' N.)

LATITUDE, 60° N. to 19° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance (b)	Change of Zenith Distance per minute of Time. (c)
0°	h m s	s.	° ' "	s.	
60 0	5 21 5	6·8	71 4 15	480·0	7·50
59 40	20 33	6·7	0 15	475·2	7·58
20	20 1	6·6	70 56 15	470·5	7·65
0	19 29	6·5	52 0	466·0	7·73
58 40	18 56	6·5	47 45	461·5	7·80
20	18 23	6·4	43 30	457·2	7·87
0	17 50	6·3	39 15	452·9	7·95
57 40	17 17	6·2	34 45	448·7	8·02
20	16 44	6·1	30 15	444·7	8·10
0	16 10	6·1	25 45	440·7	8·17
56 40	15 36	6·0	21 0	436·8	8·24
20	15 1	5·9	16 15	432·9	8·32
0	14 27	5·8	11 30	429·2	8·39
55 40	13 52	5·7	6 30	425·5	8·46
20	13 17	5·7	1 30	421·9	8·53
0	12 41	5·6	69 56 30	418·4	8·60

(a) Increased Declination add.
Hour Angle from Zenith Distance. (b) For use in finding
Decreased Declination subtract.
(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

ALDEBARAN (DECLINATION 16° 19' N.)—Continued.

LATITUDE, 60° N. to 19° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for a change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
54 40	5 12 5	5.5	69 51 15	415.0	8.68
20	11 29	5.4	46 0	411.6	8.75
0	10 53	5.4	40 45	408.3	8.82
53 40	10 16	5.3	35 15	405.1	8.89
20	9 39	5.2	29 45	401.9	8.96
0	9 1	5.2	24 15	398.7	9.03
52 40	8 24	5.1	18 30	395.7	9.10
20	7 45	5.0	12 45	392.8	9.17
0	7 7	5.0	6 45	389.8	9.23
51 40	6 28	4.9	0 45	386.9	9.30
20	5 49	4.9	68 54 45	384.1	9.37
0	5 9	4.8	48 30	381.4	9.44
50 40	4 29	4.7	42 0	378.6	9.51
20	3 48	4.7	35 45	376.0	9.57
0	3 7	4.6	29 0	373.4	9.64
49 40	2 26	4.6	22 30	370.8	9.71
20	1 44	4.5	15 30	368.3	9.77
0	1 2	4.4	8 45	365.8	9.84
48 40	0 19	4.4	1 45	363.4	9.91
20	4 59 36	4.3	67 54 30	361.0	9.97
0	58 52	4.3	47 15	358.7	10.04
47 40	58 8	4.2	39 45	356.4	10.10
20	57 23	4.2	32 15	354.1	10.17
0	56 38	4.1	24 30	351.9	10.23
46 40	55 52	4.1	16 45	349.7	10.29
20	55 6	4.0	8 45	347.6	10.36
0	54 19	4.0	0 45	345.5	10.42
45 40	53 32	3.9	66 52 15	343.4	10.48
20	52 43	3.9	44 0	341.4	10.54
0	51 55	3.8	35 15	339.4	10.61
44 40	51 5	3.8	26 30	337.5	10.67
20	50 16	3.7	17 45	335.5	10.73
0	49 25	3.7	8 45	333.6	10.79
43 40	48 34	3.6	65 59 30	331.8	10.85
20	47 42	3.6	50 0	330.0	10.91
0	46 49	3.5	40 15	328.2	10.97
42 40	45 56	3.5	30 30	326.4	11.03
20	45 2	3.4	20 30	324.7	11.09
0	44 7	3.4	10 30	323.0	11.15
41 40	43 11	3.4	0 0	321.3	11.21
20	42 14	3.3	64 49 30	319.6	11.26
0	41 17	3.3	38 45	318.0	11.32

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

ALDEBARAN (DECLINATION 16° 19' N.)—Continued.

LATITUDE. 60° N. to 19° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for a change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
40 40	4 40 19	3.2	64 27 45	316.4	11.38
20	39 20	3.2	16 30	314.8	11.44
0	38 20	3.1	5 0	313.3	11.49
39 40	37 19	3.1	63 53 15	311.8	11.55
20	36 17	3.1	41 15	310.3	11.60
0	35 14	3.0	29 0	308.8	11.66
38 40	34 10	3.0	16 45	307.4	11.71
20	33 5	2.9	4 0	306.0	11.77
0	31 59	2.9	62 51 0	304.6	11.82
37 40	30 52	2.9	37 45	303.2	11.87
20	29 43	2.8	24 15	301.8	11.93
0	28 34	2.8	10 15	300.5	11.98
36 40	27 23	2.7	61 56 0	299.2	12.03
20	26 11	2.7	41 30	297.9	12.08
0	24 57	2.6	26 45	296.7	12.14
35 40	23 43	2.6	11 45	295.4	12.19
20	22 27	2.6	60 56 15	294.2	12.24
0	21 9	2.5	40 15	293.0	12.29
34 40	19 50	2.5	24 0	291.8	12.34
20	18 29	2.5	7 30	290.6	12.39
0	17 7	2.4	59 50 30	289.5	12.44
33 40	15 43	2.4	33 0	288.4	12.48
20	14 17	2.4	15 0	287.3	12.53
0	12 50	2.3	58 56 45	286.2	12.58
32 40	11 20	2.3	38 0	285.1	12.63
20	9 49	2.2	18 45	284.0	12.67
0	8 16	2.2	57 59 0	283.0	12.72
31 40	6 40	2.2	38 45	282.0	12.77
20	5 2	2.1	18 0	281.0	12.81
0	3 22	2.1	56 56 30	280.0	12.86
30 40	1 40	2.1	34 30	279.0	12.90
20	3 59 55	2.0	12 0	278.1	12.95
0	58 8	2.0	55 48 45	277.1	12.99
29 40	56 18	2.0	25 0	276.2	13.03
20	54 25	1.9	0 15	275.3	13.08
0	52 29	1.9	54 35 0	274.4	13.12
28 40	50 30	1.8	9 0	273.5	13.16
20	48 28	1.8	53 42 15	272.7	13.20
0	46 23	1.8	14 30	271.9	13.24
27 40	44 14	1.7	52 46 15	271.0	13.28
20	42 1	1.7	16 30	270.2	13.33
0	39 44	1.7	51 46 0	269.4	13.37

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

ALDEBARAN (DECLINATION 16° 19' N.)—Continued.

LATITUDE, 60° N. to 19° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ′ ″	s.	/
26 40	3 37 23	1.6	51 14 45	268.6	13.40
20	34 58	1.6	50 42 15	267.8	13.44
0	32 28	1.6	8 30	267.0	13.48
25 40	29 53	1.5	49 33 45	266.3	13.52
20	27 13	1.5	48 57 30	265.5	13.56
0	24 27	1.4	20 0	264.8	13.59
24 40	21 36	1.4	47 41 15	264.1	13.63
20	18 38	1.4	0 45	263.4	13.67
0	15 34	1.3	46 18 45	262.7	13.70
23 40	12 22	1.3	45 35 0	262.0	13.74
20	9 3	1.3	44 49 15	261.4	13.77
0	5 36	1.2	1 30	260.7	13.81
22 40	1 59	1.1	43 11 45	260.1	13.84
20	2 58 13	1.1	42 19 30	259.5	13.88
0	54 17	1.1	41 24 45	258.8	13.91
21 40	50 9	1.1	40 27 0	258.2	13.94
20	45 48	1.0	39 26 30	257.7	13.97
0	41 14	1.0	38 22 30	257.1	14.00
20 40	36 24	1.0	37 14 45	256.5	14.03
20	31 16	.9	36 3 0	255.9	14.07
0	25 50	.9	34 46 15	255.4	14.10
19 40	26 2	.8	33 24 15	254.9	14.12
20	13 48	.8	31 56 15	254.3	14.15
0	7 5	.7	30 21 0	253.8	14.18

BETELGEUSE (DECLINATION 7° 23' N.)

LATITUDE, 60° N. to 38° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ′ ″	s.	/
60 0	5 42 50	6.9	81 28 0	480.0	7.50
59 40	42 36	6.8	26 15	475.2	7.58
20	42 22	6.7	24 30	470.5	7.65
0	42 8	6.6	22 45	466.0	7.73
58 40	41 54	6.5	20 45	461.5	7.80
20	41 40	6.4	19 0	457.2	7.87
0	41 25	6.4	17 0	452.9	7.95

(a) Increased Declination add.
Hour Angle from Zenith Distance. (b) For use in finding
Decreased Declination subtract.
(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

BETELGUESE (DECLINATION 7° 23' N.)—Continued.					
LATITUDE, 60° N. to 8° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance,	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
60° N.	h m s	s.	° ' "	s.	/
57 40	5 41 11	6.3	81 15 0	448.7	8.02
20	40 56	6.2	13 15	444.7	8.10
0	40 41	6.1	11 15	440.7	8.17
56 40	40 27	6.1	9 15	436.8	8.24
20	40 12	6.0	7 0	432.9	8.32
0	39 57	5.9	5 0	429.2	8.39
55 40	39 41	5.8	2 45	425.5	8.46
20	39 26	5.8	0 45	421.9	8.53
0	39 11	5.7	80 58 30	418.4	8.60
54 40	38 55	5.6	56 15	415.0	8.68
20	38 39	5.5	54 0	411.6	8.75
0	38 23	5.5	51 30	408.3	8.82
53 40	38 7	5.4	49 15	405.1	8.89
20	37 51	5.3	47 0	401.9	8.96
0	37 35	5.3	44 30	398.7	9.03
52 40	37 19	5.2	42 0	395.7	9.10
20	37 2	5.2	39 30	392.8	9.17
0	36 45	5.1	36 45	389.8	9.23
51 40	36 29	5.0	34 15	386.9	9.30
20	36 12	5.0	31 30	384.1	9.37
0	35 54	4.9	29 0	381.4	9.44
50 40	35 37	4.9	26 15	378.6	9.51
20	35 20	4.8	23 30	376.0	9.57
0	35 2	4.7	20 30	373.4	9.64
49 40	34 44	4.7	17 45	370.8	9.71
20	34 26	4.6	14 45	368.3	9.77
0	34 8	4.6	11 45	365.8	9.84
48 40	33 49	4.5	8 45	363.4	9.91
20	33 31	4.5	5 45	361.0	9.97
0	33 12	4.4	2 30	358.7	10.04
47 40	32 53	4.4	79 59 15	356.4	10.10
20	32 34	4.3	56 0	354.1	10.17
0	32 14	4.3	52 45	351.9	10.23
46 40	31 55	4.2	49 30	349.7	10.29
20	31 35	4.2	46 0	347.6	10.36
0	31 15	4.1	42 30	345.5	10.42
45 40	30 54	4.1	39 0	343.4	10.48
20	30 34	4.0	35 30	341.4	10.54
0	30 13	4.0	31 45	339.4	10.61
44 40	29 52	3.9	28 0	337.5	10.67
20	29 31	3.9	24 15	335.5	10.73
0	29 9	3.8	20 15	333.6	10.79

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

BETELGEUSE (DECLINATION 7° 23' N.)—Continued.

LATITUDE, 60° N. to 8° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ′ ″	s.	/
43 40	5 28 47	3·8	79 16 30	331·8	10·85
20	28 25	3·7	12 30	330·0	10·91
0	28 3	3·7	8 15	328·2	10·97
42 40	27 40	3·6	4 15	326·4	11·03
20	27 17	3·6	0 0	324·7	11·09
0	26 54	3·6	78 55 45	323 0	11·15
41 40	26 31	3·5	51 15	321·3	11·21
20	26 7	3·5	46 45	319·6	11·26
0	25 43	3·4	42 15	318·0	11·32
40 40	25 18	3·4	37 30	316·4	11·38
20	24 53	3·4	33 0	314·8	11·44
0	24 28	3·3	28 0	313·3	11·49
39 40	24 2	3·3	23 15	311·8	11·55
20	23 36	3·2	18 15	310·3	11·60
0	23 10	3·2	13 0	308·8	11·66
38 40	22 43	3·2	7 45	307·4	11·71
20	22 16	3·1	2 30	306·0	11·77
0	21 49	3·1	77 57 0	304·6	11·82
37 40	21 21	3·0	51 30	303·2	11·87
20	20 52	3·0	46 0	301·8	11·93
0	20 24	3·0	40 15	300·5	11·98
36 40	19 54	2·9	34 15	299·2	12·03
20	19 25	2·9	28 15	297·9	12·08
0	18 54	2·9	22 15	296·7	12·14
35 40	18 24	2·8	16 0	295·4	12·19
20	17 52	2·8	9 45	294·2	12·24
0	17 20	2·8	3 15	293·0	12·29
34 40	16 48	2·7	76 56 30	291·8	12·34
20	16 15	2·7	49 45	290·6	12·39
0	15 42	2·6	42 45	289·5	12·44
33 40	15 8	2·6	35 45	288·4	12·48
20	14 33	2·6	28 30	287·3	12·53
0	13 58	2·5	21 15	286·2	12·58
32 40	13 22	2·5	13 30	285·1	12·63
20	12 45	2·5	5 45	284·0	12·67
0	12 8	2·4	75 58 0	283·0	12·72
31 40	11 29	2·4	49 45	282·0	12·77
20	10 51	2·4	41 30	281·0	12·81
0	10 11	2·3	33 0	280·0	12·86
30 40	9 31	2·3	24 30	279·0	12·90
20	8 49	2·3	15 30	278·1	12·95
0	8 7	2·2	6 30	277·1	12·99

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

BETELGUESE (DECLINATION 7° 23' N.)—Continued.					
LATITUDE, 60° N. to 8° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	
29 40	5 7 24	2.2	74 57 0	276.2	13.03
20	6 40	2.2	47 30	275.3	13.08
0	5 55	2.1	37 45	274.4	13.12
28 40	5 10	2.1	27 45	273.5	13.16
20	4 23	2.1	17 30	272.7	13.20
0	3 35	2.1	6 45	271.9	13.24
27 40	2 46	2.0	73 56 0	271.0	13.28
20	1 55	2.0	44 45	270.2	13.33
0	1 4	2.0	33 30	269.4	13.37
26 40	0 11	2.0	21 45	268.6	13.40
20	4 59 17	1.9	9 30	267.8	13.44
0	58 22	1.9	72 57 15	267.0	13.48
25 40	57 26	1.9	44 30	266.3	13.52
20	56 27	1.8	31 15	265.5	13.56
0	55 28	1.8	17 45	264.8	13.59
24 40	54 27	1.8	4 0	264.1	13.63
20	53 24	1.7	71 49 45	263.4	13.67
0	52 19	1.7	35 0	262.7	13.70
23 40	51 13	1.7	19 45	262.0	13.74
20	50 4	1.6	4 0	261.4	13.77
0	48 54	1.6	70 48 0	260.7	13.81
22 40	47 42	1.6	31 15	260.1	13.84
20	46 27	1.6	14 0	259.5	13.88
0	45 10	1.5	69 56 15	258.8	13.91
21 40	43 51	1.5	37 45	258.2	13.94
20	42 29	1.5	18 45	257.7	13.97
0	41 5	1.4	68 59 15	257.1	14.00
20 40	39 38	1.4	38 45	256.5	14.03
20	38 8	1.4	17 45	255.9	14.07
0	36 35	1.4	67 55 45	255.4	14.10
19 40	34 58	1.3	33 15	254.9	14.12
20	33 18	1.3	9 30	254.3	14.15
0	31 34	1.3	66 45 0	253.8	14.18
18 40	29 47	1.2	19 45	253.3	14.21
20	27 55	1.2	65 53 15	252.8	14.24
0	25 59	1.2	25 30	252.4	14.27
17 40	23 58	1.2	64 56 45	251.9	14.30
20	21 53	1.1	26 45	251.4	14.32
0	19 41	1.1	63 55 30	251.0	14.34
16 40	17 25	1.1	22 45	250.5	14.37
20	15 2	1.1	62 48 30	250.1	14.39
0	12 32	1.0	12 45	249.7	14.42

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A).—Continued.
ELEMENTS UPON PRIME VERTICAL.

BETELGEUSE (DECLINATION $7^{\circ} 23' N.$).—Continued.

LATITUDE, $60^{\circ} N.$ to $8^{\circ} 40' N.$	Hour Angle.	Correction for change of $1'$ in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° ' "	h m s	s.	° ' "	s.	'
15 40	4 9 56	1·0	61 35 0	249·3	14·44
20	7 11	1·0	60 55 30	248·9	14·47
0	4 19	1·0	13 45	248·5	14·49
14 40	1 18	·9	59 30 0	248·1	14·51
20	3 58 6	·9	58 43 45	247·7	14·53
0	54 45	·9	57 54 45	247·3	14·55
13 40	51 11	·8	3 0	247·0	14·58
20	47 25	·8	56 8 0	246·6	14·60
0	43 25	·7	55 9 45	246·3	14·62
12 40	39 11	·7	54 7 30	246·0	14·63
20	34 37	·7	53 0 45	245·7	14·65
0	29 45	·7	51 49 30	245·4	14·67
11 40	24 31	·6	50 32 30	245·1	14·69
20	18 53	·6	49 9 45	244·8	14·71
0	12 46	·6	47 39 45	244·5	14·72
10 40	6 7	·5	46 1 45	244·2	14·74
20	2 58 50	·5	44 14 15	244·0	14·76
0	50 48	·5	42 16 0	243·7	14·77
9 40	41 53	·4	40 4 0	243·5	14·79
20	31 51	·4	37 35 30	243·2	14·80
0	20 24	·4	34 46 0	243·0	14·82
8 40	7 6	·3	31 28 45	242·8	14·83

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POLLUX (DECLINATION $28^{\circ} 15' N.$)

LATITUDE, $60^{\circ} N.$ to $33^{\circ} 20' N.$	Hour Angle.	Correction for change of $1'$ in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° ' "	h m s	s.	° ' "	s.	'
60 0	4 47 43	6·6	56 52 15	480·0	7·50
59 40	46 42	6·5	44 30	475·2	7·58
20	45 41	6·4	36 45	470·5	7·65
0	44 39	6·3	29 0	466·0	7·73
58 40	43 37	6·2	21 0	461·5	7·80
20	42 35	6·1	12 45	457·2	7·87
0	41 32	6·0	4 30	452·9	7·95
57 40	40 28	6·0	55 56 0	448·7	8·02
20	39 24	5·9	47 15	444·7	8·10
0	38 19	5·8	38 30	440·7	8·17

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

POLLOX (DECLINATION 28° 15' N.).—Continued.

LATITUDE, 60° N. to 33° 20' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	,
56 40	4 37 13	5.7	55 29 30	436.8	8.24
20	36 7	5.6	20 30	432.9	8.32
0	35 0	5.5	11 0	429.2	8.39
55 40	33 53	5.4	1 45	425.5	8.46
20	32 45	5.4	54 52 0	421.9	8.53
0	31 36	5.3	42 15	418.4	8.60
54 40	30 26	5.2	32 15	415.0	8.68
20	29 16	5.1	22 0	411.6	8.75
0	28 5	5.1	11 30	408.3	8.82
53 40	26 53	5.0	1 0	405.1	8.89
20	25 41	4.9	53 50 15	401.9	8.96
0	24 28	4.8	39 15	398.7	9.03
52 40	23 14	4.8	28 0	395.7	9.10
20	21 59	4.7	16 45	392.8	9.17
0	20 43	4.6	5 0	389.8	9.23
51 40	19 26	4.6	52 53 15	386.9	9.30
20	18 8	4.5	41 0	384.1	9.37
0	16 50	4.4	28 45	381.4	9.44
50 40	15 30	4.4	16 15	378.6	9.51
20	14 10	4.3	3 30	376.0	9.57
0	12 48	4.3	51 50 15	373.4	9.64
49 40	11 26	4.2	37 0	370.8	9.71
20	10 2	4.1	23 30	368.3	9.77
0	8 37	4.1	9 30	365.8	9.84
48 40	7 11	4.0	50 55 30	363.4	9.91
20	5 44	4.0	41 0	361.0	9.97
0	4 16	3.9	26 15	358.7	10.04
47 40	2 46	3.8	11 15	356.4	10.10
20	1 15	3.7	49 56 0	354.1	10.17
0	3 59 43	3.7	40 15	351.9	10.23
46 40	58 10	3.7	24 15	349.7	10.29
20	56 35	3.6	8 0	347.6	10.36
0	54 58	3.5	48 51 15	345.5	10.42
45 40	53 20	3.5	34 0	343.4	10.48
20	51 41	3.4	16 45	341.4	10.54
0	50 0	3.4	47 58 45	339.4	10.61
44 40	48 17	3.3	40 45	337.5	10.67
20	46 32	3.3	22 0	335.5	10.73
0	44 46	3.2	3 0	333.6	10.79
43 40	42 58	3.1	46 43 30	331.8	10.85
20	41 8	3.1	23 30	330.0	10.91
0	39 16	3.0	3 0	328.2	10.97
42 40	37 22	3.0	45 42 15	326.4	11.03
20	35 25	2.9	20 45	324.7	11.09
0	33 27	2.9	44 58 45	323.0	11.15

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

POLLOX (DECLINATION 28° 15' N.)^c—Continued.

LATITUDE. 60° N. to 33° 20' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
41 40	3 31 26	2·8	44 36 15	321·3	11·21
20	29 23	2·8	13 15	319·6	11·26
0	27 17	2·7	43 39 30	318·0	11·32
40 40	25 9	2·7	25 15	316·4	11·38
20	22 58	2·6	0 15	314·8	11·44
0	20 44	2·6	42 34 45	313·3	11·49
39 40	18 27	2·5	8 30	311·8	11·55
20	16 7	2·5	41 41 15	310·3	11·60
0	13 43	2·4	13 30	308·8	11·66
38 40	11 16	2·4	40 45 0	307·4	11·71
20	8 46	2·3	15 30	306·0	11·77
0	6 12	2·3	39 45 15	304·6	11·82
37 40	3 33	2·2	14 0	303·2	11·87
20	0 51	2·2	38 41 45	301·8	11·93
0	2 58 4	2·1	8 30	300·5	11·98
36 40	55 12	2·1	37 34 15	299·2	12·03
20	52 16	2·0	36 58 30	297·9	12·08
0	49 14	2·0	22 0	296·7	12·14
35 40	46 6	1·9	35 43 45	295·4	12·19
20	42 52	1·9	4 15	294·2	12·24
0	39 32	1·8	34 23 30	293·0	12·29
34 40	36 4	1·7	33 40 45	291·8	12·34
20	32 29	1·7	32 56 30	290·6	12·39
0	28 46	1·6	10 30	289·5	12·44
33 40	24 54	1·6	31 22 15	288·4	12·48
20	20 53	1·5	30 32 0	287·3	12·53

REGULUS (DECLINATION 12° 26' N.)

LATITUDE. 60° N. to 14° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
60 0	5 30 44	6·9	75 36 15	480·0	7·50
59 40	30 21	6·8	33 15	475·2	7·58
20	29 57	6·7	30 15	470·5	7·65
0	29 33	6·6	27 0	466·0	7·73

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

REGULUS (DECLINATION 12° 26' N.)—Continued.

LATITUDE. 60° N. to 14° 40' N.	Hour Angle.	Correction for change of 1' in declination, (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance, c. (b)	Change of Zenith Distance per minute of Time, c.
58 40	5 29 9	6.5	75 24 0	461.5	7.80
20	28 44	6.4	20 45	457.2	7.87
0	28 20	6.3	17 30	452.9	7.95
57 40	27 55	6.3	14 15	448.7	8.02
20	27 30	6.2	10 45	444.7	8.10
0	27 4	6.1	7 30	440.7	8.17
56 40	26 39	6.0	4 0	436.8	8.24
20	26 13	5.9	0 30	432.9	8.32
0	25 47	5.9	74 56 45	429.2	8.39
55 40	25 21	5.8	53 15	425.5	8.46
20	24 55	5.7	49 30	421.9	8.53
0	24 29	5.7	45 45	418.4	8.60
54 40	24 2	5.6	41 45	415.0	8.68
20	23 35	5.5	38 0	411.6	8.75
0	23 8	5.4	34 0	408.3	8.82
53 40	22 40	5.4	30 0	405.1	8.89
20	22 13	5.3	25 45	401.9	8.96
0	21 45	5.2	21 30	398.7	9.03
52 40	21 17	5.2	17 15	395.7	9.10
20	20 48	5.1	13 0	392.8	9.17
0	20 19	5.0	8 45	389.8	9.23
51 40	19 51	5.0	4 15	386.9	9.30
20	19 21	4.9	73 59 30	384.1	9.37
0	18 52	4.9	55 0	381.4	9.44
50 40	18 22	4.8	50 15	378.6	9.51
20	17 52	4.7	45 30	376.0	9.57
0	17 21	4.7	40 30	373.4	9.64
49 40	16 51	4.6	35 45	370.8	9.71
20	16 20	4.6	30 30	368.3	9.77
0	15 48	4.5	25 30	365.8	9.84
48 40	15 16	4.5	20 15	363.4	9.91
20	14 44	4.4	15 0	361.0	9.97
0	14 12	4.4	9 30	358.7	10.04
47 40	13 39	4.3	4 0	356.4	10.42
20	13 6	4.2	72 58 30	354.1	10.48
0	12 33	4.2	52 45	351.9	10.54
46 40	11 59	4.2	47 0	349.7	10.61
20	11 24	4.1	41 0	347.5	10.67
0	10 50	4.1	35 0	345.3	10.73
45 40	10 15	4.0	29 0	343.1	10.79
20	9 40	4.0	22 45	340.9	10.85
0	9 3	3.9	16 15	338.7	10.91
44 40	8 27	3.9	10 0	337.5	10.97
20	7 50	3.8	3 15	335.5	11.03
0	7 13	3.7	71 56 45	333.6	11.09

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
• Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL,

REGULUS (DECLINATION 12° 26' N.)—Continued.					
LATITUDE, 60° N. to 14° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
43 40	5 6 35	37	71 49 45	331.8	10.85
20	5 57	36	43 0	330.0	10.91
0	5 18	35	35 45	328.2	10.97
42 40	4 38	35	28 30	326.4	11.03
20	3 59	35	21 15	324.7	11.09
0	3 18	34	13 45	323.0	11.15
41 40	2 37	34	6 15	321.3	11.21
20	1 56	34	70 58 30	319.6	11.26
0	1 14	34	50 30	318.0	11.32
40 40	0 31	33	42 50	316.4	11.38
20	4 59 48	33	34 15	314.8	11.44
0	59 4	32	25 45	313.3	11.49
39 40	58 19	32	17 15	311.8	11.55
20	57 34	32	8 30	310.3	11.60
0	56 48	31	69 59 45	308.8	11.66
38 40	56 2	31	50 30	307.4	11.71
20	55 14	30	41 15	306.0	11.77
0	54 26	30	31 45	304.6	11.82
37 40	53 37	30	22 15	303.2	11.87
20	52 48	29	12 15	301.8	11.93
0	51 57	29	2 15	300.5	11.98
36 40	51 6	28	68 52 0	299.2	12.03
20	50 13	28	41 30	297.9	12.08
0	49 20	28	30 45	296.7	12.14
35 40	48 26	27	19 45	295.4	12.19
20	47 31	27	8 30	294.2	12.24
0	46 35	27	67 51 15	293.0	12.29
34 40	45 38	26	45 30	291.8	12.34
20	44 40	26	33 30	290.6	12.39
0	43 41	25	21 15	289.5	12.44
33 40	42 41	25	8 45	288.4	12.48
20	41 39	25	66 56 0	287.3	12.53
0	40 37	24	42 45	286.2	12.58
32	39 33	24	29 30	285.1	12.63
38 28	24	15 45	284.0	12.67	
37 21	23	1 45	283.0	12.72	
36 14	23	65 47 15	282.0	12.77	
35 5	23	32 30	281.0	12.81	
35 5	22	17 15	280.0	12.86	
30 40	22 41	22	1 45	279.0	12.90
20	31 16	22	64 46 0	278.1	12.95
0	30 12	22	29 45	277.1	12.99
29 40	28 55		13 0	276.2	13.03
20	27 36		63 55 45	275.3	13.08
0	26 15		38 0	274.4	13.12

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

REGULUS (DECLINATION 12° 26' N.)—Continued.

LATITUDE, 60° N. to 14° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° ' "	s.	,
28 40	4 24 52	2.0	63 20 0	273.5	13.16
20	23 27	2.0	1 15	272.7	13.20
0	22 1	1.9	62 42 15	271.9	13.24
27 40	20 32	1.9	22 30	271.0	13.28
20	19 0	1.9	2 15	270.2	13.33
0	17 27	1.8	61 41 30	269.4	13.37
26 40	15 50	1.8	20 0	268.6	13.40
20	14 12	1.8	60 57 45	267.8	13.44
0	12 30	1.7	35 0	267.0	13.48
25 40	10 46	1.7	11 30	266.3	13.52
20	8 58	1.7	59 47 15	265.5	13.56
0	7 8	1.7	22 15	264.8	13.59
24 40	5 14	1.6	58 56 30	264.1	13.63
20	3 17	1.6	29 45	263.4	13.67
0	1 16	1.6	2 15	262.7	13.70
23 40	3 59 12	1.5	57 33 45	262.0	13.74
20	57 3	1.5	4 15	261.4	13.77
0	54 50	1.4	56 33 45	260.7	13.81
22 40	52 32	1.4	2 0	260.1	13.84
20	50 10	1.4	55 29 15	259.5	13.88
0	47 43	1.4	54 55 0	258.8	13.91
21 40	45 10	1.3	19 45	258.2	13.94
20	42 31	1.3	53 42 45	257.7	13.97
0	39 47	1.3	4 30	257.1	14.00
20 40	36 56	1.2	52 24 30	256.5	14.03
20	33 58	1.2	51 42 45	255.9	14.07
0	30 52	1.1	50 59 15	255.4	14.10
19 40	27 39	1.1	13 30	254.9	14.12
20	24 16	1.1	49 26 0	254.3	14.15
0	20 45	1.1	48 36 0	253.8	14.18
18 40	17 3	1.0	47 43 30	253.3	14.21
20	13 10	1.0	46 48 15	252.8	14.24
0	9 5	1.0	45 50 0	252.4	14.27
17 40	4 46	.9	44 48 30	251.9	14.30
20	0 13	.9	43 43 30	251.4	14.32
0	2 55 24	.9	42 34 30	251.0	14.34
16 40	50 17	.8	41 21 0	250.5	14.37
20	44 50	.8	40 2 30	250.1	14.39
0	38 59	.7	38 38 15	249.7	14.42
15 40	32 42	.7	37 7 30	249.3	14.44
20	25 55	.7	35 29 30	248.9	14.47
0	18 32	.6	33 42 30	248.5	14.49
14 40	10 25	.6	31 45 0	248.1	14.51

(a) Increased Declination add.
Decreased Declination subtract.
Hour Angle from Zenith Distance.

(b) For use in finding
Zenith Distance from Hour Angle.

(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A).—Continued.
ELEMENTS UPON PRIME VERTICAL

β LEONIS (DECLINATION $15^{\circ} 7$ N.)						
LATITUDE, 60° N. to 17° 40' N.	Hour Angle.	Correction for change of 1' in declination (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith distance per minute of Time. (c)	
°	h m s	s.	° ' "	s.	,	
60 0	5 24 7	6.8	72 28 30	480.0	7.50	
59 40	23 37	6.7	24 45	475.2	7.58	
20	23 8	6.7	21 0	470.5	7.65	
0	22 38	6.6	17 15	466.0	7.73	
58 40	22 8	6.5	13 30	461.5	7.80	
20	21 38	6.4	9 30	457.2	7.87	
0	21 8	6.3	5 30	452.9	7.95	
57 40	20 37	6.2	1 15	448.7	8.02	
20	20 6	6.1	71 57 15	444.7	8.10	
0	19 35	6.1	53 0	440.7	8.17	
56 40	19 4	6.0	48 45	436.8	8.24	
20	18 32	5.9	44 15	432.9	8.32	
0	18 0	5.8	40 0	429.2	8.39	
55 40	17 28	5.8	35 30	425.5	8.46	
20	16 56	5.7	30 45	421.9	8.53	
0	16 23	5.6	26 15	418.4	8.60	
54 40	15 50	5.5	21 30	415.0	8.68	
20	15 17	5.5	16 30	411.6	8.75	
0	14 44	5.4	11 45	408.3	8.82	
53 40	14 10	5.3	6 45	405.1	8.89	
20	13 36	5.3	1 45	401.9	8.96	
0	13 1	5.2	70 56 30	398.7	9.03	
52 40	12 26	5.1	51 15	395.7	9.10	
20	11 51	5.1	46 0	392.8	9.17	
0	11 16	5.0	40 30	389.8	9.23	
51 40	10 40	4.9	35 0	386.9	9.30	
20	10 4	4.9	29 15	384.1	9.37	
0	9 28	4.8	23 30	381.4	9.44	
50 40	8 51	4.8	17 45	378.6	9.51	
20	8 13	4.7	11 45	376.0	9.57	
0	7 36	4.6	5 45	373.4	9.64	
49 40	6 58	4.6	69 59 45	370.8	9.71	
20	6 19	4.5	53 30	368.3	9.77	
0	5 41	4.5	47 0	365.8	9.84	
48 40	5 1	4.4	40 45	363.4	9.91	
20	4 22	4.4	34 0	361.0	9.97	
0	3 41	4.3	27 30	358.7	10.04	
47 40	3 1	4.3	20 30	356.4	10.10	
20	2 20	4.2	13 45	354.1	10.17	
0	1 38	4.2	6 30	351.9	10.23	
46 40	0 56	4.1	68 59 30	349.7	10.29	
20	0 14	4.0	52 0	347.6	10.36	
0	4 59 31	4.0	44 45	345.5	10.42	

(a) Increased Declination add.
Hour Angle from Zenith Distance.
(b) For use in finding
(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A).—Continued.

ELEMENTS UPON PRIME VERTICAL.

 β LEONIS (DECLINATION 15° 7' N.)—Continued.

LATITUDE, 60° N. to 17° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
o /	h m s	s.	o / "	s.	/
45 40	4 58 47	3'9	68 37 0	343·4	10·48
20	58 3	3'9	29 15	341·4	10·54
0	57 19	3'9	21 30	339·4	10·61
44 40	56 34	3'8	13 30	337·5	10·67
20	55 48	3'8	5 15	335·5	10·73
0	55 1	3'7	67 57 0	333·6	10·79
43 40	54 14	3'7	48 30	331·8	10·85
20	53 27	3'6	40 0	330·0	10·91
0	52 39	3'6	31 0	328·2	10·97
42 40	51 50	3'5	22 15	326·4	11·03
20	51 0	3'5	13 0	324·7	11·09
0	50 10	3'4	3 45	323·0	11·15
41 40	49 19	3'4	66 54 15	321·3	11·21
20	48 27	3'4	44 30	319·6	11·26
0	47 35	3'3	34 45	318·0	11·32
40 40	46 42	3'3	24 30	316·4	11·38
20	45 48	3'2	14 15	314·8	11·44
0	44 53	3'2	3 45	313·3	11·49
39 40	43 57	3'1	65 53 15	311·8	11·55
20	43 1	3'1	42 15	310·3	11·60
0	42 3	3'1	31 15	308·8	11·66
38 40	41 5	3'0	19 45	307·4	11·71
20	40 6	3'0	8 15	306·0	11·77
0	39 5	2'9	64 56 15	304·6	11·82
37 40	38 4	2'9	44 15	303·2	11·87
20	37 2	2'9	31 45	301·8	11·93
0	35 58	2'8	19 15	300·5	11·98
36 40	34 54	2'8	6 15	299·2	12·03
20	33 48	2'7	63 53 15	297·9	12·08
0	32 42	2'7	39 45	296·7	12·14
35 40	31 34	2'7	26 0	295·4	12·19
20	30 24	2'6	11 45	294·2	12·24
0	29 14	2'6	62 57 30	293·0	12·29
34 40	28 2	2'5	42 45	291·8	12·34
20	26 49	2'5	27 30	290·6	12·39
0	25 34	2'5	12 0	289·5	12·44
33 40	24 18	2'4	61 56 15	288·4	12·48
20	23 0	2'4	40 0	287·3	12·53
0	21 41	2'3	23 30	286·2	12·58
32 40	20 20	2'4	6 30	285·1	12·63
20	18 57	2'3	60 49 0	284·0	12·67
0	17 33	2'3	31 15	283·0	12·72

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.

(b) For use in finding

(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

S LEONIS (DECLINATION 15° 7' N.)—Continued.					
LATITUDE, 60° N. to 17° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° / "	s.	/
31 40	4 16 6	2:2	60 12 45	282:0	12:77
20	14 38	2:2	59 54 0	281:0	12:81
0	13 8	2:1	34 45	280:0	12:86
30 40	11 36	2:1	15 0	279:0	12:90
20	10 1	2:1	58 54 45	278:1	12:95
0	8 25	2:0	33 45	277:1	12:99
29 40	6 46	2:0	12 15	276:2	13:03
20	5 4	2:0	57 50 15	275:3	13:08
0	3 20	1:9	27 30	274:4	13:12
28 40	1 33	1:9	4 15	273:5	13:16
20	3 59 44	1:9	56 40 0	272:7	13:20
0	57 52	1:8	15 15	271:9	13:24
27 40	55 57	1:8	55 49 45	271:0	13:28
20	53 58	1:8	23 30	270:2	13:33
0	51 56	1:7	54 56 30	269:4	13:37
26 40	49 51	1:7	28 30	268:6	13:40
20	47 41	1:7	53 59 30	267:8	13:44
0	45 28	1:6	29 45	267:0	13:48
25 40	43 11	1:6	52 58 45	266:3	13:52
20	40 50	1:6	27 0	265:5	13:56
0	38 24	1:5	51 53 45	264:8	13:59
24 40	35 53	1:5	19 30	264:1	13:63
20	33 17	1:5	50 44 0	263:4	13:67
0	30 35	1:4	7 15	262:7	13:70
23 40	27 48	1:4	49 29 0	262:0	13:74
20	24 54	1:4	48 49 15	261:4	13:77
0	21 54	1:3	7 45	260:7	13:81
22 40	18 47	1:3	47 24 45	260:1	13:84
20	15 33	1:2	46 39 45	259:5	13:88
0	12 10	1:2	45 52 45	258:8	13:91
21 40	8 38	1:2	3 45	258:2	13:94
20	4 57	1:1	44 12 15	257:7	13:97
0	1 6	1:1	43 18 15	257:1	14:00
20 40	2 57 3	1:1	42 21 45	256:5	14:03
20	52 48	1:0	41 22 0	255:9	14:07
0	48 20	1:0	40 19 0	255:4	14:10
19 40	43 36	.9	39 12 15	254:9	14:12
20	38 36	.9	38 1 30	254:3	14:15
0	33 18	.9	36 46 15	253:8	14:18
18 40	27 38	.8	35 26 0	253:3	14:21
20	21 34	.8	33 59 45	252:8	14:24
0	15 2	.7	32 26 30	252:4	14:27
17 40	7 58	.7	30 45 30	251:9	14:30

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.
(c) For use in finding

(b) For use in finding
Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

ARCTURUS (DECLINATION 19° 41' N.)					
LATITUDE, 60° N. to 23° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
60 0	5 12 19	6.8	67 6 45	490.0	7.50
59 40	11 40	6.7	1 45	475.2	7.58
20	11 1	6.6	66 56 45	470.5	7.65
0	10 21	6.5	51 45	466.0	7.73
58 40	9 41	6.4	46 30	461.5	7.80
20	9 1	6.3	41 15	457.2	7.87
0	8 20	6.2	36 0	452.9	7.95
57 40	7 39	6.2	30 30	448.7	8.02
20	6 58	6.1	25 0	444.7	8.10
0	6 16	6.0	19 15	440.7	8.17
56 40	5 34	5.9	13 30	436.8	8.24
20	4 52	5.8	7 45	432.9	8.32
0	4 9	5.8	1 45	429.2	8.39
55 40	3 26	5.7	65 55 45	425.5	8.46
20	2 42	5.6	49 30	421.9	8.53
0	1 59	5.5	43 15	418.4	8.60
54 40	1 14	5.4	37 0	415.0	8.68
20	0 30	5.4	30 30	411.6	8.75
0	4 59 45	5.3	23 45	408.3	8.82
53 40	58 59	5.2	17 0	405.1	8.89
20	58 13	5.2	10 15	401.9	8.96
0	57 27	5.1	3 15	398.7	9.03
52 40	56 41	5.0	64 56 15	395.7	9.10
20	55 53	5.0	49 0	392.8	9.17
0	55 5	4.9	41 45	389.8	9.23
51 40	54 17	4.9	34 15	386.9	9.30
20	53 28	4.8	26 45	384.1	9.37
0	52 39	4.7	19 0	381.4	9.44
50 40	51 49	4.7	11 0	378.6	9.51
20	50 59	4.6	3 0	376.0	9.57
0	50 8	4.6	63 55 0	373.4	9.64
49 40	49 16	4.5	46 45	370.8	9.71
20	48 24	4.4	38 15	368.3	9.77
0	47 32	4.4	29 45	365.8	9.84
48 40	46 39	4.3	21 0	363.4	9.91
20	45 45	4.3	12 0	361.0	9.97
0	44 50	4.2	3 0	358.7	10.04
47 40	43 55	4.2	62 53 45	356.4	10.10
20	43 0	4.1	44 15	354.1	10.17
0	42 3	4.0	34 45	351.9	10.23
46 40	41 6	4.0	25 0	349.7	10.29
20	40 8	3.9	15 0	347.6	10.36
0	39 10	3.9	4 45	345.5	10.42

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

ARCTURUS (DECLINATION 19° 41' N.)—Continued.						
LATITUDE, 60° N. to 23° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)	
°	'	h m s	s.	°	'	
45	40	4 38 10	3'8	61 54 30	343.4	10.48
20		37 10	3'8	44 0	341.4	10.54
0		36 9	3'7	33 15	339.4	10.61
44	40	35 8	3'7	22 15	337.5	10.67
20		34 5	3'6	11 0	335.8	10.73
0		33 2	3'6	60 59 45	333.6	10.79
43	40	31 58	3'5	48 15	331.8	10.85
20		30 52	3'5	36 15	330.0	10.91
0		29 46	3'4	24 15	328.2	10.97
42	40	28 39	3'4	12 0	326.4	11.03
20		27 31	3'3	59 59 30	324.7	11.09
0		26 22	3'3	46 30	323.0	11.15
41	40	25 12	3'3	33 30	321.3	11.21
20		24 0	3'2	20 15	319.6	11.26
0		22 48	3'2	6 30	318.0	11.32
40	40	21 34	3'1	58 52 45	316.4	11.38
20		20 20	3'1	38 30	314.8	11.44
0		19 4	3'0	24 0	313.3	11.49
39	40	17 47	3'0	9 0	311.8	11.55
20		16 28	3'0	57 54 0	310.3	11.60
0		15 8	2'9	38 30	308.8	11.66
38	40	13 47	2'9	22 45	307.4	11.71
20		12 24	2'8	6 30	306.0	11.77
0		11 0	2'8	56 50 0	304.6	11.82
37	40	9 34	2'7	33 0	303.2	11.87
20		8 7	2'7	15 45	301.8	11.93
0		6 38	2'6	55 58 0	300.5	11.98
36	40	5 8	2'6	39 45	299.2	12.03
20		3 35	2'6	21 15	297.9	12.08
0		2 1	2'5	2 15	296.7	12.14
35	40	0 25	2'5	54 42 45	295.4	12.19
20		3 58 47	2'4	22 45	294.2	12.24
0		57 7	2'4	2 15	293.0	12.29
34	40	55 24	2'4	53 41 15	291.8	12.34
20		53 40	2'3	19 45	290.6	12.39
0		51 53	2'3	52 57 45	289.5	12.44
33	40	50 4	2'3	35 0	288.4	12.48
20		48 12	2'2	11 45	287.3	12.53
0		46 18	2'2	51 48 0	286.2	12.58
32	40	44 21	2'1	23 15	285.1	12.63
20		42 21	2'1	50 58 0	284.0	12.67
0		40 18	2'1	32 0	283.0	12.72

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

ARCTURUS (DECLINATION 19° 41' N.)—Continued.

LATITUDE. 60° N. to 23° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° ' "	s.	/
31 40	3 38 13	20	50 5 15	282.0	12.77
20	36 3	20	49 37 45	281.0	12.81
0	33 51	1.9	9 30	280.0	12.86
30 40	31 35	1.9	48 40 15	279.0	12.90
20	29 15	1.9	10 15	278.1	12.95
0	26 51	1.8	47 39 0	277.1	12.99
29 40	24 23	1.8	7 0	276.2	13.03
20	21 51	1.7	46 33 45	275.3	13.08
0	19 14	1.7	45 59 30	274.4	13.12
28 40	16 32	1.7	24 0	273.5	13.16
20	13 45	1.6	44 47 30	272.7	13.20
0	10 52	1.6	9 15	271.9	13.24
27 40	7 54	1.5	43 30 0	271.0	13.28
20	4 49	1.5	42 49 0	270.2	13.33
0	1 37	1.4	6 15	269.4	13.37
26 40	2 58 19	1.4	41 22 0	268.6	13.40
20	54 52	1.4	40 35 45	267.8	13.44
0	51 18	1.3	39 47 45	267.0	13.48
25 40	47 34	1.3	38 57 15	266.3	13.52
20	43 41	1.2	4 30	265.5	13.56
0	39 36	1.2	37 9 30	264.8	13.59
24 40	35 21	1.2	36 11 15	264.1	13.63
20	30 52	1.1	35 10 15	263.4	13.67
0	26 9	1.1	34 5 45	262.7	13.70
23 40	21 10	1.0	32 57 30	262.0	13.74
20	15 54	.9	31 44 45	261.4	13.77
0	10 17	.9	30 27 15	260.7	13.81

α CORONA (DECLINATION 27° 2' N.)

LATITUDE. 60° N. to 31° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° ' "	s.	/
60 0	4 51 28	6.6	58 20 45	480.0	7.50
59 40	50 31	6.5	13 30	475.2	7.58
20	49 33	6.4	6 15	470.5	7.65
0	48 35	6.3	57 58 45	466.0	7.73

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

a CORONAE (DECLINATION 27° 2' N.).—Continued.

LATITUDE, 60° N. to 31° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a).	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
	h m s	s.	° ' "	s.	
58 40	4 47 36	6.2	57 51 0	461.5	7.80
20	46 37	6.2	43 15	457.2	7.87
0	45 38	6.1	35 30	452.9	7.95
57 40	44 38	6.0	27 30	448.7	8.02
20	43 37	5.9	19 15	444.7	8.10
0	42 36	5.8	11 0	440.7	8.17
56 40	41 34	5.7	2 30	436.8	8.24
20	40 31	5.6	56 54 0	432.9	8.32
0	39 29	5.6	45 15	429.2	8.39
55 40	38 25	5.5	36 15	425.5	8.46
20	37 21	5.4	27 15	421.9	8.53
0	36 16	5.3	18 0	418.4	8.60
54 40	35 10	5.3	8 30	415.0	8.68
20	34 4	5.2	55 59 0	411.6	8.75
0	32 58	5.1	49 15	408.3	8.82
53 40	31 50	5.0	39 15	405.1	8.89
20	30 42	5.0	29 15	401.9	8.96
0	29 33	4.9	18 45	398.7	9.03
52 40	28 23	4.8	8 15	395.7	9.10
20	27 13	4.8	54 57 30	392.8	9.17
0	26 1	4.7	46 30	389.8	9.23
51 40	24 49	4.6	35 30	386.9	9.30
20	23 36	4.6	24 0	384.1	9.37
0	22 23	4.5	12 30	381.4	9.44
50 40	21 8	4.4	0 45	378.6	9.51
20	19 52	4.4	53 48 45	376.0	9.57
0	18 36	4.3	36 30	373.4	9.64
49 40	17 18	4.2	24 0	370.8	9.71
20	16 0	4.2	11 15	368.3	9.77
0	14 40	4.1	52 58 15	365.8	9.84
48 40	13 20	4.1	45 0	363.4	9.91
20	11 58	4.0	31 30	361.0	9.97
0	10 36	3.9	17 45	358.7	10.04
47 40	9 12	3.9	3 30	356.4	10.10
20	7 47	3.8	51 49 15	354.1	10.17
0	6 21	3.8	34 45	351.9	10.23
46 40	4 53	3.7	19 45	349.7	10.29
20	3 25	3.7	4 30	347.6	10.36
0	1 55	3.6	50 48 45	345.5	10.42
45 40	0 23	3.6	33 0	343.4	10.48
20	3 58 51	3.5	16 45	341.4	10.54
0	57 17	3.4	0 0	339.4	10.61

(a) Increased Declination add.
Hour Angle from Zenith Distance.Decreased Declination subtract.
(c) For use in finding
Zenith Distance from Hour Angle.(b) For use in finding
Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

a CORONAE (DECLINATION 27° 2' N.)					
LATITUDE, 60° N. to 31° 40' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° / "	s.	/
44 40	3 55 41	3.4	49 43 0	337.5	10.67
20	54 4	3.3	25 45	335.5	10.73
0	52 25	3.3	8 0	333.6	10.79
43 40	50 44	3.2	48 50 0	331.8	10.85
20	49 2	3.2	31 30	330.0	10.91
0	47 18	3.1	12 30	328.2	10.97
42 40	45 32	3.1	47 53 0	326.4	11.03
20	43 45	3.0	33 15	324.7	11.09
0	41 55	3.0	13 0	323.0	11.15
41 40	40 3	2.9	46 52 0	321.3	11.21
20	38 10	2.9	30 45	319.6	11.26
0	36 14	2.8	9 0	318.0	11.32
40 40	34 15	2.8	45 46 30	316.4	11.38
20	32 15	2.7	23 30	314.8	11.44
0	30 11	2.7	0 0	313.3	11.49
39 40	28 6	2.6	44 36 0	311.8	11.55
20	25 57	2.6	11 15	310.3	11.60
0	23 46	2.5	43 45 45	308.8	11.66
38 40	21 32	2.5	19 30	307.4	11.71
20	19 14	2.4	42 52 45	306.0	11.77
0	16 54	2.4	25 0	304.6	11.82
37 40	14 30	2.3	41 56 45	303.2	11.87
20	12 2	2.3	27 15	301.8	11.93
0	9 31	2.2	40 57 15	300.5	11.98
36 40	6 56	2.2	26 15	299.2	12.03
20	4 17	2.1	39 54 15	297.9	12.08
0	1 33	2.1	21 15	296.7	12.14
35 40	2 58 45	2.0	38 47 0	295.4	12.19
20	55 51	2.0	11 45	294.2	12.24
0	52 53	1.9	37 35 15	293.0	12.29
34 40	49 49	1.9	36 57 30	291.8	12.34
20	46 39	1.8	18 30	290.6	12.39
0	43 23	1.8	35 37 45	289.5	12.44
33 40	40 0	1.7	34 55 45	288.4	12.48
20	36 29	1.7	11 45	287.3	12.53
0	32 51	1.6	33 26 0	286.2	12.58
32 40	29 4	1.6	32 38 30	285.1	12.63
20	25 8	1.5	31 48 45	284.0	12.67
0	21 1	1.5	30 56 30	283.0	12.72
31 40	16 44	1.4	1 45	282.0	12.77

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

ALTAIR (DECLINATION $8^{\circ} 37' N.$)						
LATITUDE, $60^{\circ} N.$ to $10^{\circ} N.$	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Second of Time for change of one degree of Zenith Distance. (b)	Zenith Distance per minute of Time. (c)	
°	h m s	s.	° ' "	s.		
60 0	5 39 55	6.9	80 2 15	480.0	7.50	
59 40	39 39	6.8	0 15	475.2	7.58	
20	39 23	6.7	79 58 15	470.5	7.65	
0	39 6	6.6	56 0	466.0	7.73	
58 40	38 50	6.5	53 45	461.5	7.80	
20	38 33	6.5	51 45	457.2	7.87	
0	38 16	6.4	49 30	452.9	7.95	
57 40	37 59	6.3	47 15	448.7	8.02	
20	37 42	6.2	45 0	444.7	8.10	
0	37 25	6.1	42 30	440.7	8.17	
56 40	37 7	6.1	40 15	436.8	8.24	
20	36 50	6.0	37 45	432.9	8.32	
0	36 32	5.9	35 15	429.2	8.39	
55 40	36 14	5.8	32 45	425.5	8.46	
20	35 56	5.8	30 15	421.9	8.53	
0	35 38	5.7	27 45	418.4	8.60	
54 40	35 20	5.6	25 0	415.0	8.68	
20	35 2	5.5	22 30	411.6	8.75	
0	34 43	5.5	19 45	408.3	8.82	
53 40	34 24	5.4	17 0	405.1	8.89	
20	34 5	5.3	14 15	401.9	8.96	
0	33 46	5.3	11 15	398.7	9.03	
52 40	33 27	5.2	8 15	395.7	9.10	
20	33 8	5.1	5 30	392.8	9.17	
0	32 48	5.1	2 30	389.8	9.23	
51 40	32 28	5.0	78 59 15	386.9	9.30	
20	32 8	5.0	56 15	384.1	9.37	
0	31 48	4.9	53 0	381.4	9.44	
50 40	31 28	4.8	49 45	378.6	9.51	
20	31 8	4.8	46 30	376.0	9.57	
0	30 47	4.7	43 15	373.4	9.64	
49 40	30 26	4.7	40 0	370.8	9.71	
20	30 5	4.6	36 30	368.3	9.77	
0	29 43	4.6	33 0	365.8	9.84	
48 40	29 22	4.5	29 30	363.4	9.91	
20	29 0	4.5	25 45	361.0	9.97	
0	28 38	4.4	22 15	358.7	10.04	
47 40	28 16	4.4	18 30	356.4	10.10	
20	27 53	4.3	14 30	354.1	10.17	
0	27 30	4.2	10 45	351.9	10.23	
46 40	27 7	4.2	6 45	349.7	10.29	
20	26 44	4.1	2 45	347.6	10.36	
0	26 21	4.1	77 58 45	345.5	10.42	

(a) Increased Declination add.
Hour Angle from Zenith Distance.Decreased Declination subtract.
(c) For use in finding Zenith Distance from Hour Angle.(b) For use in finding
Zenith Distance from Hour Angle.

TABLE II. A.—Continued.

ELEMENTS UPON PRIME VERTICAL.

ALTAIR (DECLINATION 8° 37' N.)—Continued.

LATITUDE, 60° N. to 10° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	
45 40	5 25 57	40	77 54 30	343·4	10·48
20	25 33	40	50 15	341·4	10·54
0	25 8	40	46 0	339·4	10·61
44 40	24 44	3·9	41 45	337·5	10·67
20	24 19	3·9	37 15	335·5	10·73
0	23 53	3·8	32 45	333·6	10·79
43 40	23 28	3·8	28 0	331·8	10·85
20	23 2	3·7	23 15	330·0	10·91
0	22 36	3·7	18 30	328·2	10·97
42 40	22 9	3·6	13 45	326·4	11·03
20	21 42	3·6	8 45	324·7	11·09
0	21 15	3·5	3 45	323·0	11·15
41 40	20 47	3·5	76 58 30	321·3	11·21
20	20 19	3·5	53 15	319·6	11·26
0	19 51	3·4	48 0	318·0	11·32
40 40	19 22	3·4	42 30	316·4	11·38
20	18 53	3·4	37 0	314·8	11·44
0	18 23	3·3	31 15	313·3	11·49
39 40	17 53	3·3	25 30	311·8	11·55
20	17 22	3·2	19 45	310·3	11·60
0	16 52	3·2	13 45	308·8	11·66
38 40	16 20	3·1	7 30	307·4	11·71
20	15 48	3·1	1 15	306·0	11·77
0	15 16	3·1	75 55 0	304·6	11·82
37 40	14 43	3·0	48 30	303·2	11·87
20	14 10	3·0	41 45	301·8	11·93
0	13 36	3·0	35 0	300·5	11·98
36 40	13 1	2·9	28 15	299·2	12·03
20	12 26	2·9	21 15	297·9	12·08
0	11 51	2·8	14 0	296·7	12·14
35 40	11 15	2·8	6 45	295·4	12·19
20	10 38	2·8	74 59 15	294·2	12·24
0	10 0	2·7	51 30	293·0	12·29
34 40	9 22	2·7	43 45	291·8	12·34
20	8 44	2·7	35 45	290·6	12·39
0	8 4	2·6	27 30	289·5	12·44
33 40	7 24	2·6	19 15	288·4	12·48
20	6 43	2·6	10 45	287·3	12·53
0	6 1	2·5	2 0	286·2	12·58
32 40	5 19	2·5	73 53 0	285·1	12·63
20	4 36	2·5	44 0	284·0	12·67
0	3 52	2·4	34 30	283·0	12·72

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

ALTAIR (DECLINATION 8° 37' N.)—Continued.

LATITUDE, 60° N. to 10° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
31 40	5 3 7	2·4	73 25 0	282·0	12·77
20	2 21	2·4	15 15	281·0	12·81
0	1 34	2·3	5 15	280·0	12·86
30 40	0 47	2·3	72 55 0	279·0	12·90
20	4 59 58	2·3	44 30	278·1	12·95
0	59 8	2·2	33 45	277·1	12·99
29 40	58 17	2·2	22 45	276·2	13·03
20	57 25	2·2	11 30	275·3	13·08
0	56 32	2·1	0 0	274·4	13·12
28 40	55 38	2·1	71 48 0	273·5	13·16
20	54 43	2·1	36 0	272·7	13·20
0	53 46	2·0	23 30	271·9	13·24
27 40	52 48	2·0	10 30	271·0	13·28
20	51 48	2·0	70 57 15	270·2	13·33
0	50 48	1·9	43 45	269·4	13·37
26 40	49 45	1·9	30 0	268·6	13·40
20	48 41	1·9	15 30	267·8	13·44
0	47 36	1·9	1 0	267·0	13·48
25 40	46 29	1·8	69 45 45	266·3	13·52
20	45 20	1·8	30 15	265·5	13·56
0	44 9	1·8	14 15	264·8	13·59
24 40	42 56	1·7	68 57 45	264·1	13·63
20	41 41	1·7	40 45	263·4	13·67
0	40 24	1·7	23 15	262·7	13·70
23 40	39 5	1·6	5 0	262·0	13·74
20	37 44	1·6	67 46 30	261·4	13·77
0	36 20	1·6	27 15	260·7	13·81
22 40	34 54	1·6	7 15	260·1	13·84
20	33 25	1·5	66 46 45	259·5	13·88
0	31 53	1·5	25 30	258·8	13·91
21 40	30 19	1·5	3 30	258·2	13·94
20	28 41	1·4	65 40 45	257·7	13·97
0	27 0	1·4	17 15	257·1	14·00
20 40	25 15	1·4	64 52 45	256·5	14·03
20	23 27	1·4	27 30	255·9	14·07
0	21 35	1·3	1 15	255·4	14·10
19 40	19 39	1·3	63 34 0	254·9	14·12
20	17 39	1·3	5 30	254·3	14·15
0	15 34	1·3	62 36 0	253·8	14·18
18 40	13 24	1·2	5 15	253·3	14·21
20	11 9	1·2	61 33 15	252·8	14·24
0	8 48	1·1	0 0	252·4	14·27

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

ALTAIR (DECLINATION 8° 37' N.)—Continued.

LATITUDE. 60° N. to 10° N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
17 40	4 6 22	1·1	60 25 0	251·9	14·30
20	3 49	1·1	59 48 30	251·4	14·32
0	1 9	1·1	· 10 30	251·0	14·34
16 40	3 58 22	1·0	58 30 30	250·5	14·37
20	55 27	1·0	57 48 30	250·1	14·39
0	52 24	1·0	4 30	249·7	14·42
15 40	49 11	1·0	56 18 0	249·3	14·44
20	45 48	·9	55 29 15	248·9	14·47
0	42 15	·9	54 37 45	248·5	14·49
14 40	38 29	·8	53 43 15	248·1	14·51
20	34 30	·8	52 45 30	247·7	14·53
0	30 17	·8	51 44 0	247·3	14·55
13 40	25 48	·8	50 38 45	247·0	14·58
20	21 1	·7	49 29 0	246·6	14·60
0	15 54	·7	48 14 15	246·3	14·62
12 40	10 25	·7	46 54 0	246·0	14·63
20	4 31	·6	45 27 30	245·7	14·65
0	2 58 7	·6	43 53 45	245·4	14·67
11 40	51 9	·6	42 11 30	245·1	14·69
20	43 32	·5	40 19 30	244·8	14·71
0	35 7	·5	38 15 45	244·5	14·72
10 40	25 44	·5	35 57 30	244·2	14·74
20	15 9	·4	33 21 30	244·0	14·76
0	3 1	·4	30 22 0	243·7	14·77

MARKAB (DECLINATION 14° 42' N.)

LATITUDE. 6° N. to 17° 20' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
60 0	5 25 9	6·8	72 57 45	480·0	7·50
59 40	24 41	6·8	54 0	475·2	7·58
20	24 12	6·7	50 30	470·5	7·65
0	23 43	6·6	46 45	466·0	7·73
58 40	23 14	6·5	43 0	461·5	7·80
20	22 45	6·4	39 15	457·2	7·87
0	22 16	6·3	35 15	452·9	7·95

(a) Increased Declination add.
Hour Angle from Zenith Distance.

(b) For use in finding
Zenith Distance from Hour Angle.

(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

MARKAB (DECLINATION 14° 42' N.)—Continued.

LATITUDE, 60° N. to 17° 20' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance (b)	Change of Zenith Distance per minute of Time. (c)
57 40	5 21 46	6.2	72 31 30	448.7	
20	21 16	6.1	27 15	444.7	8.02
0	20 46	6.1	23 15	440.7	8.10
56 40	20 15	6.0	19 0	436.8	8.17
20	19 45	5.9	15 0	432.9	8.24
0	19 14	5.8	10 30	429.2	8.32
55 40	18 43	5.8	6 15	425.5	8.39
20	18 11	5.7	1 45	421.9	8.46
0	17 40	5.6	71 57 15	418.4	8.53
54 40	17 8	5.5	52 45	415.0	8.60
20	16 35	5.5	48 0	411.6	8.68
0	16 3	5.4	43 15	408.3	8.75
53 40	15 30	5.3	38 15	405.1	8.82
20	14 57	5.3	33 30	401.9	8.89
0	14 24	5.2	28 30	398.7	8.96
52 40	13 50	5.1	23 15	395.7	9.03
20	13 16	5.1	18 15	392.8	9.10
0	12 41	5.0	13 0	389.8	9.17
51 40	12 7	5.0	7 30	386.9	9.23
20	11 32	4.9	2 0	384.1	9.30
0	10 56	4.8	70 56 30	381.4	9.37
50 40	10 21	4.8	50 45	378.6	9.44
20	9 44	4.7	45 15	376.0	9.51
0	9 8	4.7	39 15	373.4	9.57
49 40	8 31	4.6	33 15	370.8	9.64
20	7 54	4.5	27 15	368.3	9.71
0	7 16	4.5	21 15	365.8	9.77
48 40	6 38	4.4	15 0	363.4	9.84
20	6 0	4.4	8 30	361.0	9.91
0	5 21	4.3	2 0	358.7	9.97
47 40	4 41	4.3	69 55 30	356.4	10.04
20	4 2	4.2	48 45	354.1	10.10
0	3 21	4.2	41 45	351.9	10.17
46 40	2 41	4.1	35 0	349.7	10.23
20	2 0	4.1	27 45	347.6	10.29
0	1 18	4.0	20 30	345.5	10.36
45 40	0 36	4.0	13 15	343.4	10.42
20	4 59 53	3.9	5 45	341.4	10.48
0	59 10	3.9	68 58 15	339.4	10.54
44 40	58 26	3.8	50 30	337.5	10.61
20	57 42	3.8	42 30	335.5	10.67
0	56 57	3.7	34 30	333.6	10.73

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.
(c) For use in finding

(b) For use in finding
Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

MARKAB (DECLINATION $14^{\circ} 42' N.$)—Continued.

LATITUDE, $60^{\circ} N.$ $17^{\circ} 20' N.$	Hour Angle.	Correction for change of $1'$ in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
o /	h m s	s.	o . ' "	s.	
43 40	4 56 11	3.7	68 26 15	331.8	10.85
20	55 25	3.6	18 0	330.0	10.91
0	54 38	3.6	9 15	328.2	10.97
42 40	53 51	3.5	0 45	326.4	11.03
20	53 3	3.5	67 51 45	324.7	11.09
0	52 14	3.4	42 45	323.0	11.15
41 40	51 25	3.4	33 45	321.3	11.21
20	50 35	3.4	24 15	319.6	11.26
0	49 44	3.3	14 45	318.0	11.32
40 40	48 53	3.3	5 0	316.4	11.38
20	48 1	3.2	66 55 0	314.8	11.44
0	47 7	3.2	44 45	313.3	11.49
39 40	46 14	3.1	34 30	311.8	11.55
20	45 19	3.1	24 0	310.3	11.60
0	44 23	3.1	13 15	308.8	11.66
38 40	43 27	3.0	2 15	307.4	11.71
20	42 29	3.0	65 51 0	306.0	11.77
0	41 31	2.9	39 30	304.6	11.82
37 40	40 32	2.9	27 45	303.2	11.87
20	39 32	2.9	15 45	301.8	11.93
0	38 30	2.8	3 45	300.5	11.98
36 40	37 28	2.8	64 51 15	299.2	12.03
20	36 24	2.8	38 30	297.9	12.08
0	35 20	2.7	25 30	296.7	12.14
35 40	34 14	2.7	12 0	295.4	12.19
20	33 7	2.6	63 58 30	294.2	12.24
0	31 59	2.6	44 30	293.0	12.29
34 40	30 50	2.6	30 15	291.8	12.34
20	29 39	2.5	15 45	290.6	12.39
0	28 27	2.5	0 45	289.5	12.44
33 40	27 13	2.5	62 45 30	288.4	12.48
20	25 58	2.4	29 45	287.3	12.53
0	24 42	2.4	13.45	286.2	12.58
32 40	23 23	2.3	61 57 30	285.1	12.63
20	22 4	2.3	40 30	284.0	12.67
0	20 42	2.3	23 15	283.0	12.72
31 40	19 19	2.2	5 45	282.0	12.77
20	17 54	2.2	60 47 30	281.0	12.81
0	16 27	2.2	29 0	280.0	12.86
30 40	14 58	2.1	9 45	279.0	12.90
20	13 27	2.1	59 50 15	278.1	12.95
0	11 54	2.1	30 0	277.1	12.99

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

MARKAB (DECLINATION 14° 42' N.)—Continued.					
LATITUDE, 60° N. to 17° 20' N.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
29 40	4 10 18	2.0	59 9 30	276.2	13.03
20	8 41	2.0	58 48 15	275.3	13.08
0	7 1	2.0	26 15	274.4	13.12
28 40	5 18	1.9	3 45	273.5	13.16
20	3 33	1.9	57 40 45	272.7	13.20
0	1 45	1.9	16 45	271.9	13.24
27 40	3 59 54	1.8	56 52 15	271.0	13.28
20	58 0	1.8	27 0	270.2	13.33
0	56 3	1.7	1 0	269.4	13.37
26 40	54 2	1.7	55 34 15	268.6	13.40
20	51 58	1.7	6 30	267.8	13.44
0	49 50	1.6	54 37 45	267.0	13.48
25 40	47 39	1.6	8 15	266.3	13.52
20	45 23	1.6	53 37 30	265.5	13.56
0	43 3	1.5	6 0	264.8	13.59
24 40	40 39	1.5	52 33 15	264.1	13.63
20	38 10	1.5	51 59 15	263.4	13.67
0	35 35	1.4	24 0	262.7	13.70
23 40	32 56	1.4	50 47 30	262.0	13.74
20	30 10	1.4	9 30	261.4	13.77
0	27 18	1.3	49 30 0	260.7	13.81
22 40	24 20	1.3	48 49 0	260.1	13.84
20	21 15	1.3	6 15	259.5	13.88
0	18 2	1.2	47 21 30	258.8	13.91
21 40	14 41	1.2	46 35 0	258.2	13.94
20	11 12	1.2	45 46 15	257.7	13.97
0	7 33	1.1	44 55 15	257.1	14.00
20 40	3 44	1.1	1 45	256.5	14.03
20	2 59 44	1.1	43 5 30	255.9	14.07
0	55 31	1.0	42 6 15	255.4	14.10
19 40	51 6	1.0	41 3 45	254.9	14.12
20	46 25	.9	39 57 30	254.3	14.15
0	41 28	.9	38 47 30	253.8	14.18
18 40	36 13	.9	37 33 0	253.3	14.21
20	30 37	.8	36 13 15	252.8	14.24
0	24 37	.8	34 47 45	252.4	14.27
17 40	18 11	.7	33 15 45	251.9	14.30
20	11 12	.7	31 36 0	251.4	14.32

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding Zenith Distance from Hour Angle.
(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—*Continued.*
ELEMENTS UPON PRIME VERTICAL.

RIGEL (DECLINATION 8° 19' S.)					
LATITUDE, 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
60 0	5 40 38	6.9	80 23 0	480.0	7.50
59 40	40 22	6.8	21 15	475.2	7.58
20	40 7	6.7	19 15	470.5	7.65
0	39 51	6.6	17 0	466.0	7.73
58 40	39 35	6.5	15 0	461.5	7.80
20	39 18	6.5	13 0	457.2	7.87
0	39 2	6.4	10 45	452.9	7.95
57 40	38 46	6.3	8 30	448.7	8.02
20	38 29	6.2	6 15	444.7	8.10
0	38 13	6.1	4 0	440.7	8.17
56 40	37 56	6.1	1 45	436.8	8.24
20	37 39	6.0	79 59 30	432.9	8.32
0	37 22	5.9	57 0	429.2	8.39
55 40	37 5	5.8	54 45	425.5	8.46
20	36 47	5.8	52 15	421.9	8.53
0	36 30	5.7	49 45	418.4	8.60
54 40	36 12	5.6	47 15	415.0	8.68
20	35 55	5.5	44 45	411.6	8.75
0	35 37	5.4	42 0	408.3	8.82
53 40	35 19	5.4	39 30	405.1	8.89
20	35 1	5.3	36 45	401.9	8.96
0	34 42	5.3	34 0	398.7	9.03
52 40	34 24	5.2	31 0	395.7	9.10
20	34 5	5.1	28 15	392.8	9.17
0	33 46	5.1	25 30	389.8	9.23
51 40	33 27	5.0	22 30	386.9	9.30
20	33 8	5.0	19 30	384.1	9.37
0	32 48	4.9	16 30	381.4	9.44
50 40	32 29	4.8	13 15	378.6	9.51
20	32 9	4.8	10 15	376.0	9.57
0	31 49	4.7	7 0	373.4	9.64
49.40	31 29	4.7	3 45	370.8	9.71
20	31 8	4.6	0 30	368.3	9.77
0	30 48	4.6	78 57 0	365.8	9.84
48 40	30 27	4.5	53 30	363.4	9.91
20	30 6	4.5	50 15	361.0	9.97
0	29 45	4.4	46 30	358.7	10.04
47 40	29 23	4.4	43 0	356.4	10.10
20	29 2	4.3	39 15	354.1	10.17
0	28 40	4.2	35 30	351.9	10.23
46 40	28 17	4.2	31 45	349.7	10.29
20	27 55	4.1	28 0	347.6	10.36
0	27 32	4.1	24 0	345.5	10.42

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

RIGEL (DECLINATION 8° 19' S.)—Continued.					
LATITUDE, 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
45 40	5 27 9	4·1	78 20 0	343·4	10·48
20	26 46	4·0	16 0	341·4	10·54
0	26 23	4·0	11 45	339·4	10·61
44 40	25 59	3·9	7 30	337·5	10·67
20	25 35	3·9	3 15	335·5	10·73
0	25 10	3·8	77 59 0	333·6	10·79
43 40	24 46	3·8	54 30	331·8	10·85
20	24 21	3·7	50 0	330·0	10·91
0	23 55	3·7	45 15	328·2	10·97
42 40	23 30	3·6	40 30	326·4	11·03
20	23 4	3·6	35 45	324·7	11·09
0	22 38	3·6	31 0	323·0	11·15
41 40	22 11	3·5	26 0	321·3	11·21
20	21 44	3·5	21 0	319·6	11·26
0	21 17	3·4	15 45	318·0	11·32
40 40	20 49	3·4	10 30	316·4	11·38
20	20 21	3·3	5 15	314·8	11·44
0	19 52	3·3	76 59 45	313·3	11·49
39 40	19 23	3·3	54 15	311·8	11·55
20	18 54	3·2	48 30	310·3	11·60
0	18 24	3·2	42 45	308·8	11·66
38 40	17 54	3·1	36 45	307·4	11·71
20	17 23	3·1	30 45	306·0	11·77
0	16 52	3·1	24 45	304·6	11·82
37 40	16 20	3·0	18 30	303·2	11·87
20	15 48	3·0	12 0	301·8	11·93
0	15 15	3·0	5 30	300·5	11·98
36 40	14 42	2·9	75 59 0	299·2	12·03
20	14 9	2·9	52 15	297·9	12·08
0	13 34	2·8	45 15	296·7	12·14
35 40	12 59	2·8	38 15	295·4	12·19
20	12 24	2·8	31 0	294·2	12·24
0	11 48	2·7	23 30	293·0	12·29
34 40	11 11	2·7	16 0	291·8	12·34
20	10 34	2·7	8 30	290·6	12·39
0	9 56	2·6	0 30	289·5	12·44
33 40	9 17	2·6	74 52 30	288·4	12·48
20	8 38	2·6	44 15	287·3	12·53
0	7 58	2·5	36 0	286·2	12·58
32 40	7 17	2·5	27 15	285·1	12·63
20	6 35	2·5	18 30	284·0	12·67
0	5 53	2·4	9 30	283·0	12·72

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

RIGEL (DECLINATION 8° 19' S.)—Continued.

LATITUDE, 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
31 40	5 5 10	2.4	74 0 30	282.0	12.77
20	4 26	2.4	73 51 0	281.0	12.81
0	3 41	2.3	41 30	280.0	12.86
30 40	2 55	2.3	31 30	279.0	12.90
20	2 8	2.3	21 30	278.1	12.95
0	1 20	2.2	11 0	277.1	12.99
29 40	0 31	2.2	0 30	276.2	13.03
20	4 59 41	2.2	72 49 30	275.3	13.08
0	58 50	2.1	38 30	274.4	13.12
28 40	57 58	2.1	27 0	273.5	13.16
20	57 5	2.1	15 15	272.7	13.20
0	56 10	2.0	3 15	271.9	13.24
27 40	55 14	2.0	71 51 0	271.0	13.28
20	54 17	2.0	38 15	270.2	13.33
0	53 19	2.0	25 15	269.4	13.37
26 40	52 19	1.9	12 0	268.6	13.40
20	51 17	1.9	70 58 15	267.8	13.44
0	50 14	1.9	44 0	267.0	13.48
25 40	49 10	1.8	29 30	266.3	13.52
20	48 3	1.8	14 30	265.5	13.56
0	46 55	1.8	69 59 15	264.8	13.59
24 40	45 45	1.7	43 15	264.1	13.63
20	44 34	1.7	27 0	263.4	13.67
0	43 20	1.7	10 0	262.7	13.70
23 40	42 4	1.7	68 52 45	262.0	13.74
20	40 46	1.6	34 45	261.4	13.77
0	39 25	1.6	16 15	260.7	13.81
22 40	38 3	1.6	67 57 15	260.1	13.84
20	36 37	1.5	37 30	259.5	13.88
0	35 9	1.5	17 15	258.8	13.91
21 40	33 38	1.5	66 56 0	258.2	13.94
*20	32 5	1.5	34 15	257.7	13.97
0	30 28	1.4	11 45	257.1	14.00
20 40	28 48	1.4	65 48 15	256.5	14.03
20	27 4	1.4	24 0	255.9	14.07
0	25 17	1.3	64 59 0	255.4	14.10
19 40	23 26	1.3	32 45	254.9	14.12
20	21 30	1.3	5 30	254.3	14.15
0	19 31	1.3	63 37 15	253.8	14.18
18 40	17 27	1.2	8 0	253.3	14.21
20	15 17	1.2	62 37 15	252.8	14.24
0	13 3	1.2	5 30	252.4	14.27

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

RIGEL (DECLINATION 8° 19' S.)—Continued.

LATITUDE. 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° / "	s.	/
17 40	4 10 43	1·1	61 32 0	251·9	14·30
20	8 17	1·1	60 57 15	251·4	14·32
0	5 45	1·1	21 0	251·0	14·34
16 40	3 5	1·0	59 42 45	250·5	14·37
20	0 19	1·0	2 45	250·1	14·39
0	3 57 24	1·0	58 20 45	249·7	14·42
15 40	54 21	1·0	57 36 45	249·3	14·44
20	51 8	·9	56 50 15	248·9	14·47
0	47 45	·9	1 15	248·5	14·49
14 40	44 11	·9	55 9 45	248·1	14·51
20	40 25	·9	54 15 0	247·7	14·53
0	36 25	·8	53 16 45	247·3	14·55
13 40	32 11	·8	52 15 0	247·0	14·58
20	27 40	·7	51 9 15	246·6	14·60
0	22 52	·7	49 59 0	246·3	14·62
12 40	17 42	·7	48 43 45	246·0	14·63
20	12 10	·7	47 22 30	245·7	14·65
0	6 12	·6	45 55 0	245·4	14·67
11 40	2 59 43	·6	44 20 0	245·1	14·69
20	52 40	·5	42 36 15	244·8	14·71
0	44 56	·5	40 42 30	244·5	14·72
10 40	36 22	·5	38 36 15	244·2	14·74
20	26 49	·4	36 15 30	244·0	14·76
0	16 0	·4	33 35 45	243·7	14·77
9 40	3 32	·3	30 31 30	243·5	14·79

SIRIUS (DECLINATION 16° 35' S.)

LATITUDE. 60° S. to 19° 20' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° / "	s.	/
60 0	5 20 24	6·8	70 45 30	480·0	7·50
59 40	19 52	6·7	41 30	475·2	7·58
20	19 19	6·6	37 15	470·5	7·65
0	18 46	6·5	33 0	466·0	7·73

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

SIRIUS (DECLINATION 16° 35' S.)—Continued.

LATITUDE. 60° S. to 19° 20' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
58 40	5 18 13	6.5	70 28 45	461.5	7.80
20	17 40	6.4	24 30	457.2	7.87
0	17 6	6.3	20 0	452.9	7.95
57 40	16 32	6.2	15 30	448.7	8.02
20	15 58	6.1	11 0	444.7	8.10
0	15 24	6.1	6 15	440.7	8.17
56 40	14 49	6.0	1 30	436.8	8.24
20	14 14	5.9	69 56 45	432.9	8.32
0	13 39	5.8	51 45	429.2	8.39
55 40	13 3	5.7	46 45	425.5	8.46
20	12 28	5.7	41 45	421.9	8.53
0	11 51	5.6	36 30	418.4	8.60
54 40	11 15	5.5	31 15	415.0	8.68
20	10 38	5.4	26 0	411.6	8.75
0	10 1	5.4	20 30	408.3	8.82
53 40	9 24	5.3	15 0	405.1	8.89
20	8 46	5.2	9 30	401.9	8.96
0	8 8	5.2	3 45	398.7	9.03
52 40	7 29	5.1	68 57 45	395.7	9.10
20	6 50	5.0	52 0	392.8	9.17
0	6 11	5.0	46 0	389.8	9.23
51 40	5 31	4.9	39 45	386.9	9.30
20	4 51	4.9	33 30	384.1	9.37
0	4 11	4.8	27 15	381.4	9.44
50 40	3 30	4.7	20 45	378.6	9.51
20	2 49	4.7	14 15	376.0	9.57
0	2 7	4.6	7 30	373.4	9.64
49 40	1 25	4.6	0 45	370.8	9.71
20	0 42	4.5	67 53 45	368.3	9.77
0	4 59 59	4.4	46 45	365.8	9.84
48 40	59 16	4.4	39 30	363.4	9.91
20	58 32	4.3	32 15	361.0	9.97
0	57 47	4.3	25 0	358.7	10.04
47 40	57 2	4.2	17 15	356.4	10.10
20	56 17	4.2	9 45	354.1	10.17
0	55 30	4.1	1 45	351.9	10.23
46 40	54 44	4.1	66 53 45	349.7	10.29
20	53 57	4.0	45 45	347.6	10.36
0	53 9	4.0	37 30	345.5	10.42
45 40	52 20	3.9	29 0	343.4	10.48
20	51 32	3.9	20 30	341.4	10.54
0	50 42	3.8	11 45	339.4	10.61
44 40	49 52	3.8	2 45	337.5	10.67
20	49 1	3.7	65 53 45	335.5	10.73
0	48 9	3.7	44 30	333.6	10.79

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.
(c) For use in finding Zenith Distance from Hour Angle.

(b) For use in finding

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL,

SIRIUS (DECLINATION 16° 35' S.)—Continued.

LATITUDE, 60° S. to 19° 20' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° '	h m "	s.	° ' "	s.	'
43 40	4 47 17	3·6	65 35 0	331·8	10·85
20	46 24	3·6	25 30	330·0	10·91
0	45 30	3·5	15 45	328·2	10·97
42 40	44 36	3·5	5 45	326·4	11·03
20	43 41	3·4	64 55 30	324·7	11·09
0	42 45	3·4	45 0	323·0	11·15
41 40	41 48	3·3	34 30	321·3	11·21
20	40 50	3·3	23 45	319·6	11·26
0	39 52	3·3	12 45	318·0	11·32
40 40	38 53	3·2	1 30	316·4	11·38
20	37 52	3·2	63 50 0	314·8	11·44
0	36 51	3·1	38 15	313·3	11·49
39 40	35 49	3·1	26 30	311·8	11·55
20	34 46	3·1	14 15	310·3	11·60
0	33 42	3·0	1 45	308·8	11·66
38 40	32 36	3·0	62 49 0	307·4	11·71
20	31 30	2·9	36 15	306·0	11·77
0	30 23	2·9	23 0	304·6	11·82
37 40	29 14	2·9	9 15	303·2	11·87
20	28 4	2·8	61 55 30	301·8	11·93
0	26 53	2·8	41 15	300·5	11·98
36 40	25 41	2·7	27 0	299·2	12·03
20	24 28	2·7	12 15	297·9	12·08
0	23 13	2·6	60 57 0	296·7	12·14
35 40	21 56	2·6	41 30	295·4	12·19
20	20 39	2·6	25 45	294·2	12·24
0	19 19	2·5	9 30	293·0	12·29
34 40	17 59	2·5	59 53 0	291·8	12·34
20	16 36	2·5	36 0	290·6	12·39
0	15 12	2·4	18 30	289·5	12·44
33 40	13 46	2·4	0 45	288·4	12·48
20	12 19	2·3	58 42 30	287·3	12·53
0	10 49	2·3	23 45	286·2	12·58
32 40	9 18	2·3	4 30	285·1	12·63
20	7 45	2·2	57 45 0	284·0	12·67
0	6 9	2·2	24 45	283·0	12·72
31 40	4 32	2·2	4 0	282·0	12·77
20	2 52	2·1	56 42 45	281·0	12·81
0	1 10	2·1	20 45	280·0	12·86
30 40	3 59 25	2·1	55 58 30	279·0	12·90
20	57 38	2·0	35 15	278·1	12·95
0	55 48	2·0	11 30	277·1	12·99
29 40	53 55	1·9	54 47 0	276·2	13·03
20	52 0	1·9	22 0	275·3	13·08
0	50 1	1·9	53 56 0	274·4	13·12

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

SIRIUS (DECLINATION 16° 35' S.)—Continued.

LATITUDE. 60° S. to 19° 20' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
28 40	3 47 59	1.8	53 29 30	273.5	13.16
20	45 54	1.8	2 0	272.7	13.20
0	43 45	1.8	52 33 30	271.9	13.24
27 40	41 33	1.7	4 15	271.0	13.28
20	39 17	1.7	51 34 0	270.2	13.33
0	36 56	1.7	3 0	269.4	13.37
26 40	34 32	1.6	50 30 30	268.6	13.40
20	32 3	1.6	49 57 15	267.8	13.44
0	29 29	1.6	22 45	267.0	13.48
25 40	26 49	1.5	48 46 45	266.3	13.52
20	24 5	1.5	9 45	265.5	13.56
0	21 15	1.4	47 31 15	264.8	13.59
24 40	18 18	1.4	46 51 15	264.1	13.63
20	15 15	1.4	9 30	263.4	13.67
0	12 5	1.3	45 26 15	262.7	13.70
23 40	8 47	1.3	44 41 0	262.0	13.74
20	5 22	1.3	43 53 45	261.4	13.77
0	1 47	1.2	4 30	260.7	13.81
22 40	2 58 4	1.2	42 13 0	260.1	13.84
20	54 9	1.1	41 19 0	259.5	13.88
0	50 4	1.1	40 22 0	258.8	13.91
21 40	45 47	1.1	39 22 15	258.2	13.94
20	41 16	1.0	38 19 15	257.7	13.97
0	36 30	1.0	37 12 45	257.1	14.00
20 40	31 27	.9	36 2 0	256.5	14.03
20	26 6	.9	34 46 45	259.9	14.07
0	20 23	.8	33 26 15	255.4	14.10
19 40	14 16	.8	32 0 0	254.9	14.12
20	7 41	.8	30 26 45	254.3	14.15

a HYDRA (DECLINATION 8° 15' S.)

LATITUDE. 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
°	h m s	s.	° ' "	s.	'
60 0	5 40 48	6.9	80 27 45	480.0	7.50
59 40	40 32	6.8	25 45	475.2	7.58
20	40 16	6.7	23 45	470.5	7.65
0	40 0	6.6	21 45	466.0	7.73

(a) Increased Declination add.
Hour Angle from Zenith Distance.
(b) For use in finding
Zenith Distance from Hour Angle.
(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

a HYDRA (DECLINATION $8^{\circ} 15' S.$).—Continued.

LATITUDE, $60^{\circ} S.$ to $9^{\circ} 40' S.$	Hour Angle.	Correction for change of 1' in declination. (a).	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° / "	s.	/
58 40	5 39 45	6·5	80 19 45	461·5	7·80
20	39 29	6·5	17 45	457·2	7·87
0	39 12	6·4	15 30	452·9	7·95
57 40	38 56	6·3	13 15	448·7	8·02
20	38 40	6·2	11 15	444·7	8·10
0	38 23	6·1	9 0	440·7	8·17
56 40	38 7	6·1	6 45	436·8	8·24
20	37 50	6·0	4 15	432·9	8·32
0	37 33	5·9	2 0	429·2	8·39
55 40	37 16	5·8	79 59 30	425·5	8·46
20	36 59	5·8	57 15	421·9	8·53
0	36 42	5·7	54 45	418·4	8·60
54 40	36 24	5·6	52 15	415·0	8·68
20	36 6	5·5	49 30	411·6	8·75
0	35 49	5·5	47 0	408·3	8·82
53 40	35 31	5·4	44 15	405·1	8·89
20	35 13	5·3	41 45	401·9	8·96
0	34 55	5·3	39 0	398·7	9·03
52 40	34 37	5·2	36 15	395·7	9·10
20	34 18	5·1	33 15	392·8	9·17
0	33 59	5·1	30 30	389·8	9·23
51 40	33 40	5·0	27 30	386·9	9·30
20	33 21	5·0	24 30	384·1	9·37
0	33 2	4·9	21 30	381·4	9·44
50 40	32 42	4·8	18 30	378·6	9·51
20	32 23	4·8	15 30	376·0	9·57
0	32 3	4·7	12 15	373·4	9·64
49 40	31 43	4·7	9 0	370·8	9·71
20	31 23	4·6	5 45	368·3	9·77
0	31 2	4·6	2 30	365·8	9·84
48 40	30 42	4·5	78 59 0	363·4	9·91
20	30 21	4·5	55 30	361·0	9·97
0	30 0	4·4	52 0	358·7	10·04
47 40	29 38	4·4	48 30	356·4	10·10
20	29 17	4·3	44 45	354·1	10·17
0	28 55	4·3	41 0	351·9	10·23
46 40	28 33	4·2	37 15	349·7	10·29
20	28 11	4·1	33 30	347·6	10·36
0	27 48	4·1	29 30	345·5	10·42
45 40	27 25	4·0	25 45	343·4	10·48
20	27 2	4·0	21 30	341·4	10·54
0	26 39	4·0	17 30	339·4	10·61
44 40	26 16	3·9	13 15	337·5	10·67
20	25 52	3·9	9 0	335·5	10·73
0	25 28	3·8	4 45	333·6	10·79

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.

(b) For use in finding
Zenith Distance from Hour Angle.

(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

a HYDRE (DECLINATION $8^{\circ} 15'$ S.)—Continued.

LATITUDE, 60° S. to $9^{\circ} 40'$ S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
0	h m s	s.	° ′ ″	s.	/
43 40	5 25 3	3.8	78 0 15	331.8	10.85
20	24 38	3.7	77 55 45	330.0	10.91
0	24 13	3.7	51 15	328.2	10.97
42 40	23 48	3.6	46 30	326.4	11.03
20	23 22	3.6	41 45	324.7	11.09
0	22 56	3.6	37 0	323.0	11.15
41 40	22 30	3.5	32 0	321.3	11.21
20	22 3	3.5	27 0	319.6	11.26
0	21 36	3.4	22 0	318.0	11.32
40 40	21 8	3.4	16 45	316.4	11.38
20	20 40	3.3	11 30	314.8	11.44
0	20 12	3.3	6 0	313.3	11.49
39 40	19 43	3.3	0 30	311.8	11.55
20	19 14	3.2	76 55 0	310.3	11.60
0	18 45	3.2	49 15	308.8	11.66
38 40	18 15	3.1	43 15	307.4	11.71
20	17 44	3.1	37 30	306.0	11.77
0	17 13	3.1	31 15	304.6	11.82
37 40	16 42	3.0	25 15	303.2	11.87
20	16 10	3.0	18 45	301.8	11.93
0	15 38	3.0	12 15	300.5	11.98
36 40	15 5	2.9	5 45	299.2	12.03
20	14 31	2.9	75 59 0	297.9	12.08
0	13 57	2.8	52 15	296.7	12.14
35 40	13 23	2.8	45 15	295.4	12.19
20	12 48	2.8	38 0	294.2	12.24
0	12 12	2.7	30 45	293.0	12.29
34 40	11 35	2.7	23 15	291.8	12.34
20	10 58	2.7	15 45	290.6	12.39
0	10 21	2.6	7 45	289.5	12.44
33 40	9 42	2.6	0 0	288.4	12.48
20	9 3	2.6	74 51 45	287.3	12.53
0	8 24	2.5	43 30	286.2	12.58
32 40	7 43	2.5	35 0	285.1	12.63
20	7 2	2.5	26 15	284.0	12.67
0	6 20	2.4	17 15	283.0	12.72
31 40	5 37	2.4	8 15	282.0	12.77
20	4 53	2.4	73 59 0	281.0	12.81
0	4 9	2.3	49 30	280.0	12.86
30 40	3 23	2.3	39 30	279.0	12.90
20	2 37	2.3	29 30	278.1	12.95
0	1 49	2.2	19 15	277.1	12.99
29 40	1 1	2.2	8 45	276.2	13.03
20	0 11	2.2	72 58 0	275.3	13.08
0	4 59 21	2.1	47 0	274.4	13.12

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

a HYDRA (DECLINATION 8° 15' S.)—Continued.					
LATITUDE, 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
° /	h m s	s.	° / "	s.	/
28 40	4 58 29	2·1	72 35 45	273·5	13·16
20	57 36	2·1	24 0	272·7	13·20
0	56 42	2·1	12 15	271·9	13·24
27 40	55 47	2·0	0 0	271·0	13·28
20	54 50	2·0	71 47 30	270·2	13·33
0	53 52	2·0	34 30	269·4	13·37
26 40	52 53	1·9	21 15	268·6	13·40
20	51 52	1·9	7 30	267·8	13·44
0	50 49	1·9	70 53 30	267·0	13·48
25 40	49 45	1·8	39 15	266·3	13·52
20	48 40	1·8	24 15	265·5	13·56
0	47 32	1·8	9 0	264·8	13·59
24 40	46 23	1·8	69 53 30	264·1	13·63
20	45 12	1·7	37 15	263·4	13·67
0	43 59	1·7	20 30	262·7	13·70
23 40	42 43	1·7	3 15	262·0	13·74
20	41 26	1·6	68 45 30	261·4	13·77
0	40 6	1·6	27 15	260·7	13·81
22 40	38 44	1·6	8 15	260·1	13·84
20	37 20	1·5	67 48 45	259·5	13·88
0	35 53	1·5	28 45	258·8	13·91
21 40	34 23	1·5	7 45	258·2	13·94
20	32 50	1·5	66 46 15	257·7	13·97
0	31 14	1·4	23 45	257·1	14·00
20 40	29 35	1·4	0 30	256·5	14·03
20	27 52	1·4	65 36 30	255·9	14·07
0	26 6	1·3	11 45	255·4	14·10
19 40	24 16	1·3	64 45 45	254·9	14·12
20	22 22	1·3	18 45	254·3	14·15
0	20 23	1·3	63 51 0	253·8	14·18
18 40	18 20	1·3	21 45	253·3	14·21
20	16 12	1·2	62 51 30	252·8	14·24
0	13 59	1·2	20 0	252·4	14·27
17 40	11 41	1·1	61 47 0	251·9	14·30
20	9 16	1·1	12 30	251·4	14·32
0	6 45	1·1	60 36 30	251·0	14·34
16 40	4 8	1·1	59 58 45	250·5	14·37
20	1 23	1·0	19 15	250·1	14·39
0	3 58 30	1·0	58 37 45	249·7	14·42
15 40	55 29	1·0	57 54 0	249·3	14·44
20	52 18	·9	8 15	248·9	14·47
0	48 58	·9	56 19 45	248·5	14·49
14 40	45 26	·9	55 28 45	248·1	14·51
20	41 43	·9	54 34 30	247·7	14·53
0	37 46	·8	53 37 15	247·3	14·55

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

α HYDRAE (DECLINATION 8° 15' S.)—Continued.

LATITUDE, 60° S. to 9° 40' S.	Hour Angle.	Correction for change of 1' in declination, (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance, (b)	Change of Zenith Distance per minute of Time, (c)
0°	h m s	s.	o ' "	s.	'
13 40	3 33 35	.8	52 36 15	247.0	14.58
20	29 8	.8	51 31 15	246.6	14.60
0	24 23	.7	50 22 0	246.3	14.62
12 40	19 18	.7	49 7 30	246.0	14.63
20	13 50	.7	47 47 45	245.7	14.65
0	7 57	.6	46 21 30	245.4	14.67
11 40	1 35	.6	44 47 45	245.1	14.69
20	2 54 39	.6	43 6 0	244.8	14.71
0	47 3	.5	41 14 0	244.5	14.72
10 40	38 39	.5	39 10 30	244.2	14.74
20	29 18	.4	36 52 30	244.0	14.76
0	18 44	.4	34 16 30	243.7	14.77
9 40	6 37	.4	31 17 30	243.5	14.79

SPICA (DECLINATION 10° 40' S.)

LATITUDE, 60° S. to 12° 40' S.	Hour Angle.	Correction for change of 1' in declination, (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance (b)	Change of Zenith Distance per minute of Time, (c)
0°	h m s	s.	o ' "	s.	'
60 0	5 35 2	6.9	77 39 30	480.0	7.50
59 40	34 41	6.8	37 0	475.2	7.58
20	34 21	6.7	34 30	470.5	7.65
0	34 0	6.6	31 45	466.0	7.73
58 40	33 40	6.5	29 0	461.5	7.80
20	33 19	6.4	26 15	457.2	7.87
0	32 58	6.3	23 30	452.9	7.95
57 40	32 37	6.3	20 45	448.7	8.02
20	32 15	6.2	18 0	444.7	8.10
0	31 54	6.1	15 0	440.7	8.17
56 40	31 32	6.0	12 0	436.8	8.24
20	31 10	6.0	9 0	432.9	8.32
0	30 48	5.9	6 0	429.2	8.39
55 40	30 26	5.8	2 45	425.5	8.46
20	30 4	5.7	76 59 45	421.9	8.53
0	29 41	5.7	56 30	418.4	8.60

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A).—Continued.
ELEMENTS UPON PRIME VERTICAL.

SPICA (DECLINATION 10° 40' S.)—Continued.

LATITUDE, 60° S. to 12° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
54 40	5 29 18	5'6	76 53 15	415·0	8·68
20	28 55	5·5	49 45	411·6	8·75
0	28 32	5·5	46 30	408·3	8·82
53 40	28 9	5'4	43 0	405·1	8·89
20	27 45	5·3	39 30	401·9	8·96
0	27 22	5·3	36 0	398·7	9·03
52 40	26 58	5'2	32 15	395·7	9·10
20	26 34	5·1	28 45	392·8	9·17
0	26 9	5·1	25 0	389·8	9·23
51 40	25 44	5·0	21 0	386·9	9·30
20	25 20	4·9	17 15	384·1	9·37
0	24 54	4·9	13 15	381·4	9·44
50 40	24 29	4·8	9 15	378·6	9·51
20	24 3	4·8	5 15	376·0	9·57
0	23 38	4·7	1 0	373·4	9·64
49 40	23 11	4·6	75 56 45	370·8	9·71
20	22 45	4·6	52 30	368·3	9·77
0	22 18	4·5	48 15	365·8	9·84
48 40	21 51	4·5	43 45	363·4	9·91
20	21 24	4·4	39 15	361·0	9·97
0	20 57	4·4	34 45	358·7	10·04
47 40	20 29	4·3	30 0	356·4	10·10
20	20 1	4·3	25 15	354·1	10·17
0	19 32	4·2	20 30	351·9	10·23
46 40	19 3	4·2	15 30	349·7	10·29
20	18 34	4·1	10 30	347·6	10·36
0	18 5	4·1	5 15	345·5	10·42
45 40	17 35	4·0	0 15	343·4	10·48
20	17 5	4·0	74 55 0	341·4	10·54
0	16 34	3·9	49 30	339·4	10·61
44 40	16 4	3·9	44 0	337·5	10·67
20	15 32	3·8	38 30	335·5	10·73
0	15 1	3·8	32 45	333·6	10·79
43 40	14 29	3·7	27 0	331·8	10·85
20	13 56	3·7	21 15	330·0	10·91
0	13 23	3·7	15 15	328·2	10·97
42 40	12 50	3·6	9 0	326·4	11·03
20	12 16	3·6	2 45	324·7	11·09
0	11 42	3·5	73 56 30	323·0	11·15
41 40	11 7	3·5	50 0	321·3	11·21
20	10 32	3·4	43 30	319·6	11·26
0	9 57	3·4	36 45	318·0	11·32

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

SPICA (DECLINATION 10° 40' S.)—Continued.

LATITUDE. 60° S. to 12° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time	Change of Zenith Distance per minute of Time. (c)
				for change of one degree of Zenith Distance. (b)	
0° /	h m s	s.	° / "	s.	/
40 40	5 9 21	3·4	73 30 0	316·4	11·38
20	8 44	3·3	23 0	314·8	11·44
0	8 7	3·3	15 45	313·3	11·49
39 40	7 29	3·2	8 30	311·8	11·55
20	6 51	3·2	1 15	310·3	11·60
0	6 12	3·1	72 53 45	308·8	11·66
38 40	5 33	3·1	46 0	307·4	11·71
20	4 53	3·1	38 15	306·0	11·77
0	4 12	3·0	30 15	304·6	11·82
37 40	3 31	3·0	22 0	303·2	11·87
20	2 49	3·0	13 45	301·8	11·93
0	2 6	2·9	5 15	300·5	11·98
36 40	1 23	2·9	71 56 30	299·2	12·03
20	0 39	2·8	47 45	297·9	12·08
0	4 59 54	2·8	38 45	296·7	12·14
35 40	59 8	2·8	29 30	295·4	12·19
20	58 22	2·7	20 0	294·2	12·24
0	57 35	2·7	10 30	293·0	12·29
34 40	56 47	2·7	0 30	291·8	12·34
20	55 58	2·6	70 50 30	290·6	12·39
0	55 8	2·6	40 15	289·5	12·44
33 40	54 18	2·6	29 45	288·4	12·48
20	53 26	2·5	19 0	287·3	12·53
0	52 34	2·5	8 0	286·2	12·58
32 40	51 40	2·4	69 56 45	285·1	12·63
20	50 45	2·4	45 15	284·0	12·67
0	49 50	2·4	33 15	283·0	12·72
31 40	48 53	2·3	21 15	282·0	12·77
20	47 55	2·3	9 0	281·0	12·81
0	46 56	2·3	68 56 15	280·0	12·86
30 40	45 55	2·3	43 15	279·0	12·90
20	44 53	2·2	30 0	278·1	12·95
0	43 50	2·2	16 15	277·1	12·99
29 40	42 46	2·2	2 30	276·2	13·03
20	41 40	2·1	67 48 0	275·3	13·08
0	40 33	2·1	33 15	274·4	13·12
28 40	39 24	2·1	18 15	273·5	13·16
20	38 13	2·0	2 45	272·7	13·20
0	37 1	2·0	66 46 45	271·9	13·24
27 40	35 47	2·0	30 30	271·0	13·28
20	34 31	1·9	13 45	270·2	13·33
0	33 13	1·9	65 56 15	269·4	13·37

(a) Increased Declination add.
Hour Angle from Zenith Distance.Decreased Declination subtract.
(c) For use in finding(b) For use in finding
Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

SPICA (DECLINATION 10° 40' S.)—Continued.

LATITUDE, 60° S. to 12° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
• /	h m s	s.	° ' "	s.	'
26 40	4 31 54	1.9	65 38 30	268.6	13.40
20	30 32	1.8	20 15	267.8	13.44
0	29 8	1.8	1 30	267.0	13.48
25 40	27 42	1.8	64 42 0	266.3	13.52
20	26 13	1.7	22 0	265.5	13.56
0	24 42	1.7	1 30	264.8	13.59
24 40	23 9	1.7	63 40 15	264.1	13.63
20	21 33	1.6	18 30	263.4	13.67
0	19 54	1.6	62 55 45	262.7	13.70
23 40	18 12	1.6	32 30	262.0	13.74
20	16 26	1.6	8 30	261.4	13.77
0	14 38	1.5	61 43 30	260.7	13.81
22 40	12 46	1.5	17 45	260.1	13.84
20	10 51	1.5	60 51 0	259.5	13.88
0	8 51	1.4	23 15	258.8	13.91
21 40	6 48	1.4	59 54 45	258.2	13.94
20	4 40	1.4	25 0	257.7	13.97
0	2 28	1.3	58 54 15	257.1	14.00
20 40	0 11	1.3	22 0	256.5	14.03
20	3 57 48	1.3	57 48 45	255.9	14.07
0	55 21	1.2	14 15	255.4	14.10
19 40	52 47	1.2	56 38 0	254.9	14.12
20	50 8	1.2	0 30	254.3	14.15
0	47 21	1.2	55 21 15	253.8	14.18
18 40	44 28	1.1	54 40 0	253.3	14.21
20	41 27	1.1	53 57 15	252.8	14.24
0	38 17	1.1	12 15	252.4	14.27
17 40	34 59	1.0	52 25 0	251.9	14.30
20	31 31	1.0	51 35 30	251.4	14.32
0	27 53	1.0	50 43 15	251.0	14.34
16 40	24 3	.9	49 48 30	250.5	14.37
20	20 1	.9	48 50 15	250.1	14.39
0	15 46	.9	47 49 0	249.7	14.42
15 40	11 15	.8	46 43 45	249.3	14.44
20	6 27	.8	45 34 30	248.9	14.47
0	1 21	.8	44 20 45	248.5	14.49
14 40	2 55 54	.7	43 1 30	248.1	14.51
20	50 3	.7	41 36 45	247.7	14.53
0	43 45	.7	40 5 0	247.3	14.55
13 40	36 56	.6	38 25 45	247.0	14.58
20	29 29	.6	36 37 15	246.6	14.60
0	21 19	.5	34 38 0	246.3	14.62
12 40	12 16	.5	32 25 30	246.0	14.63

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.
(c) For use in finding

(b) For use in finding
Zenith Distance from Hour Angle.

TABLE II. (A).—Continued.

ELEMENTS UPON PRIME VERTICAL.

ANTARES (DECLINATION 26° 13' S.)

LATITUDE, 60° S. to 31° S. ^b	Hour Angle.	Correction for change of 1' in declination (a)	Zenith Distance,	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith distance per minute of Time. (c).
0	h m s	s.	° ' "	s.	'
60 0	4 53 56	6·6	59 19 45	480·0	7·50
59 40	53 1	6·5	12 45	475·2	7·58
20°	52 5	6·5	5 45	470·5	7·65
0	51 10	6·4	58 58 45	466·0	7·73
58 40	50 13	6·3	51 15	461·5	7·80
20	49 16	6·2	44 0	457·2	7·87
0	48 19	6·1	36 15	452·9	7·95
57 40	47 21	6·0	28 45	448·7	8·02
20	46 23	5·9	20 45	444·7	8·10
0	45 24	5·8	12 45	440·7	8·17
56 40	44 25	5·8	4 45	436·8	8·24
20	43 25	5·7	57 56 30	432·9	8·32
0	42 24	5·6	48 0	429·2	8·39
55 40	41 23	5·5	39 30	425·5	8·46
20	40 22	5·4	30 45	421·9	8·53
0	39 19	5·4	22 0	418·4	8·60
54 40	38 16	5·3	12 45	415·0	8·68
20	37 13	5·2	3 30	411·6	8·75
0	36 9	5·1	56 54 15	408·3	8·82
53 40	35 4	5·1	44 45	405·1	8·89
20	33 59	5·0	35 0	401·9	8·96
0	32 52	4·9	25 0	398·7	9·03
52 40	31 46	4·9	15 0	395·7	9·10
20	30 38	4·8	4 30	392·8	9·17
0	29 30	4·7	55 54 0	389·8	9·23
51 40	28 21	4·7	43 30	386·9	9·30
20	27 11	4·6	32 30	384·1	9·37
0	26 0	4·5	21 30	381·4	9·44
50 40	24 48	4·5	10 0	378·6	9·51
20	23 36	4·4	54 58 45	376·0	9·57
0	22 23	4·3	47 0	373·4	9·64
49 40	21 9	4·3	35 0	370·8	9·71
20	19 53	4·2	22 45	368·3	9·77
0	18 37	4·2	10 15	365·8	9·84
48 40	17 20	4·1	53 57 45	363·4	9·91
20	16 2	4·0	44 45	361·0	9·97
0	14 43	4·0	31 30	358·7	10·04
47 40	13 23	3·9	18 0	356·4	10·10
20	12 2	3·9	4 30	354·1	10·17
0	10 40	3·8	52 50 30	351·9	10·23
46 40	9 16	3·8	36 15	349·7	10·29
20	7 51	3·7	21 30	347·6	10·36
0	6 26	3·6	6 45	345·5	10·42

(a) Increased Declination add.

Hour Angle from Zenith Distance.

Decreased Declination subtract.

(c) For use in finding Zenith Distance from Hour Angle.

(b) For use in finding

TABLE II. (A).—Continued.
ELEMENTS UPON PRIME VERTICAL.

ANTARES (DECLINATION 26° 13' S.)—Continued.					
LATITUDE, 60° S. to 31° S.	Hour Angle.	Correction for change of 1' in declination, (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance, (b)	Change of Zenith Distan- ce per minute of Time, (c)
45 40	4 4 58	3·6	51 51 30	343·4	10·48
20	3 30	3·5	36 0	341·4	10·54
0	2 0	3·5	20 15	339·4	10·61
44 40	0 29	3·4	4 0	337·5	10·67
20	3 58 56	3·4	50 47 30	335·5	10·73
0	57 22	3·3	30 30	333·6	10·79
43 40	55 46	3·3	13 15	331·8	10·85
20	54 9	3·2	49 55 45	330·0	10·91
0	52 30	3·2	37 45	328·2	10·97
42 40	50 50	3·1	19 15	326·4	11·03
20	49 7	3·1	0 15	324·7	11·09
0	47 23	3·0	48 41 0	323·0	11·15
41 40	45 37	3·0	21 15	321·3	11·21
20	43 49	2·9	1 0	319·6	11·26
0	41 59	2·9	47 40 15	318·0	11·32
40 40	40 7	2·8	19 15	316·4	11·38
20	38 13	2·8	46 57 30	314·8	11·44
0	36 16	2·7	35 15	313·3	11·49
39 40	34 17	2·7	12 15	311·8	11·55
20	32 16	2·6	45 49 0	310·3	11·60
0	30 12	2·6	24 45	308·8	11·66
38 40	28 5	2·5	0 15	307·4	11·71
20	25 55	2·5	44 34 45	306·0	11·77
0	23 43	2·4	8 45	304·6	11·82
37 40	21 28	2·4	43 42 0	303·2	11·87
20	19 9	2·3	14 45	301·8	11·93
0	16 47	2·3	42 46 15	300·5	11·98
36 40	14 22	2·2	17 15	299·2	12·03
20	11 52	2·2	41 47 15	297·9	12·08
0	9 19	2·1	16 15	296·7	12·14
35 40	6 42	2·1	40 44 30	295·4	12·19
20	4 1	2·0	11 45	294·2	12·24
0	1 15	2·0	39 37 45	293·0	12·29
34 40	2 58 24	2·0	2 45	291·8	12·34
20	55 28	1·9	38 26 15	290·6	12·39
0	52 26	1·8	37 48 45	289·5	12·44
33 40	49 19	1·8	10 0	288·4	12·48
20	46 5	1·7	36 29 30	287·3	12·53
0	42 45	1·7	35 47 45	286·2	12·58
32 40	39 18	1·6	4 0	285·1	12·63
20	35 43	1·6	34 18 45	284·0	12·67
0	31 59	1·5	33 31 30	283·0	12·72
31 40	28 7	1·5	32 42 0	282·0	12·77
20	24 4	1·4	31 50 30	281·0	12·81
0	19 51	1·4	30 56 15	280·0	12·86

(a) Increased Declination add.
Hour Angle from Zenith Distance.

Decreased Declination subtract.

(b) For use in finding
Zenith Distance from Hour Angle.

(c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.
ELEMENTS UPON PRIME VERTICAL.

FOMALHAUT (DECLINATION 30° 8' S.)

LATITUDE, 60° S. to 35° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
60 0	4 41 41	6.5	54 34 15	480.0	7.50
59 40.	40 35	6.4	26 0	475.2	7.58
20	39 28	6.3	17 30	470.5	7.65
0	38 21	6.2	9 0	466.0	7.73
58 40	37 13	6.2	0 15	461.5	7.80
20	36 5	6.1	53 51 15	457.2	7.87
0	34 56	6.0	42 15	452.9	7.95
57 40	33 46	5.9	33 0	448.7	8.02
20	32 36	5.8	23 30	444.7	8.10
0	31 25	5.7	14 0	440.7	8.17
56 40	30 14	5.6	4 0	436.8	8.24
20	29 1	5.5	52 54 0	432.9	8.32
0	27 48	5.5	44 0	429.2	8.39
55 40	26 34	5.4	33 30	425.5	8.46
20	25 20	5.3	23 0	421.9	8.53
0	24 4	5.2	12 15	418.4	8.60
54 40	22 48	5.1	1 15	415.0	8.68
20	21 31	5.1	51 50 0	411.6	8.75
0	20 14	5.0	38 45	408.3	8.82
53 40	18 55	4.9	27 15	405.1	8.89
20	17 35	4.8	15 30	401.9	8.96
0	16 15	4.8	3 15	398.7	9.03
52 40	14 53	4.7	50 51 0	395.7	9.10
20	13 31	4.6	38 30	392.8	9.17
0	12 8	4.5	25 30	389.8	9.23
51 40	10 43	4.5	12 30	386.9	9.30
20	9 18	4.4	49 59 15	384.1	9.37
0	7 51	4.4	45 45	381.4	9.44
50 40	6 23	4.3	31 45	378.6	9.51
20	4 55	4.2	17 45	376.0	9.57
0	3 25	4.2	3 15	373.4	9.64
49 40	1 53	4.1	48 48 30	370.8	9.71
20	0 21	4.0	33 30	368.3	9.77
0	3 58 47	4.0	18 15	365.8	9.84
48 40	57 12	3.9	2 30	363.4	9.91
20	55 36	3.8	47 46 30	361.0	9.97
0	53 58	3.8	30 15	358.7	10.04
47 40	52 18	3.7	13 30	356.4	10.10
20	50 37	3.7	46 56 30	354.1	10.17
0	48 55	3.6	39 15	351.9	10.23
46 40	47 11	3.6	21 15	349.7	10.29
20	45 25	3.5	3 15	347.6	10.36
0	43 38	3.4	45 44 30	345.5	10.42

(a) Increased Declination add. Decreased Declination subtract. (b) For use in finding
Hour Angle from Zenith Distance. (c) For use in finding Zenith Distance from Hour Angle.

TABLE II. (A.)—Continued.

ELEMENTS UPON PRIME VERTICAL.

FOMALHAUT (DECLINATION 30° 8' S.)—Continued.

LATITUDE, 60° S. to 35° 40' S.	Hour Angle.	Correction for change of 1' in declination. (a)	Zenith Distance.	Seconds of Time for change of one degree of Zenith Distance. (b)	Change of Zenith Distance per minute of Time. (c)
45 40	3 41 48	3·4	45 25 30	343·4	10·48
20	39 57	3·3	6 0	341·4	10·54
0	38 4	3·3	44 46 0	339·4	10·61
44 40	36 9	3·2	25 45	337·5	10·67
20	34 12	3·1	4 45	335·5	10·73
0	32 13	3·1	43 43 30	333·6	10·79
43 40	30 11	3·0	21 30	331·8	10·85
20	28 7	3·0	42 59 0	330·0	10·91
0	26 1	2·9	36 0	328·2	10·97
42 40	23 52	2·9	12 30	326·4	11·03
20	21 41	2·8	41 48 15	324·7	11·09
0	19 26	2·8	23 15	323·0	11·15
41 40	17 9	2·7	40 57 45	321·3	11·21
20	14 49	2·7	31 30	319·6	11·26
0	12 26	2·6	4 30	318·0	11·32
40 40	9 59	2·5	39 36 45	316·4	11·38
20	7 29	2·5	8 15	314·8	11·44
0	4 55	2·4	38 39 0	313·3	11·49
39 40	2 18	2·4	8 45	311·8	11·55
20	2 59 36	2·3	37 37 30	310·3	11·60
0	56 50	2·3	5 15	308·8	11·66
38 40	54 0	2·2	36 32 0	307·4	11·71
20	51 4	2·1	35 57 45	306·0	11·77
0	48 4	2·1	22 15	304·6	11·82
37 40	44 58	2·0	34 45 45	303·2	11·87
20	41 47	2·0	7 45	301·8	11·93
0	38 29	1·9	33 28 15	300·5	11·98
36 40	35 4	1·9	32 47 15	299·2	12·03
20	31 33	1·8	4 45	297·9	12·08
0	27 53	1·7	31 20 30	296·7	12·14
35 40	24 5	1·7	30 34 15	295·4	12·19

(a) Increased Declination add.
Hour Angle from Zenith Distance.(b) For use in finding
Zenith Distance from Hour Angle.

(c) For use in finding Zenith Distance from Hour Angle.

TABLES II. (B) AND II. (C).

VALUES OF SECOND CORRECTION

**LIMIT OF LATITUDE 60° LIMIT OF DISTANCE IN HOUR
ANGLE FROM PRIME VERTICAL 90^m .**

TABLE II (B.)

FOR USE IN FINDING HOUR ANGLE FROM OBSERVED ZENITH DISTANCE.

SECOND CORRECTION

(ADDITIONAL TO FIRST CORRECTION).

LATITUDE* or DECLINATION.	APPROXIMATE DISTANCE IN HOUR ANGLE FROM PRIME VERTICAL.														
	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
°	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.	sec.
60	1.2	2.4	4.0	6.2	9.2	13.0	17.8	24.0	31.0	39.2	48.9	60.2	73.0	87.8	104.0
55	1.0	2.1	3.5	5.4	8.1	11.7	15.9	21.3	27.6	35.1	43.8	53.2	65.4	78.5	93.1
50	.9	1.7	3.0	4.8	7.2	10.3	14.0	18.6	24.1	30.7	38.3	47.2	57.3	68.6	81.4
45	.7	1.5	2.5	4.1	6.1	8.7	11.9	15.8	20.6	26.1	32.6	40.1	48.8	58.4	69.4
40	.6	1.2	2.1	3.4	5.1	7.2	9.8	13.1	17.0	21.7	27.0	33.2	40.3	48.3	57.3
35	.5	1.0	1.7	2.7	4.0	5.7	7.8	10.4	13.5	17.2	21.5	26.5	32.1	38.5	45.7
30	.4	.8	1.3	2.1	3.1	4.3	5.9	7.9	10.3	13.1	16.4	20.1	24.4	29.3	34.7
25	.3	.5	.9	1.5	2.2	3.1	4.3	5.7	7.4	9.4	11.7	14.3	17.4	20.9	24.8
20	.2	.3	.5	1.0	1.4	2.0	2.8	3.7	4.8	6.1	7.7	9.4	11.4	13.7	16.3
15	.1	.2	.3	.5	.8	1.1	1.6	2.1	2.8	3.5	4.3	5.4	6.5	7.8	9.3
10	—	.1	.1	.3	.4	.5	.7	.9	1.2	1.6	2.0	2.4	2.9	3.5	4.2
5	—	—	—	.1	.1	.2	.2	.3	.3	.4	.5	.6	.8	.9	1.1

* For observations near Prime Vertical Latitude of Place is the Argument. For observations near Maximum Azimuth Declination of Star is the Argument.

TABLE II. (C.)

FOR USE IN CALCULATING ZENITH DISTANCE CORRESPONDING TO A GIVEN * HOUR ANGLE.

SECOND CORRECTION

(SUBTRACTIVE FROM FIRST CORRECTION).

LATITUDE* or DECLINATION.	APPROXIMATE DISTANCE IN HOUR ANGLE FROM PRIME VERTICAL OR MAX. AZIMUTH.														
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
60	9 17	29 46	1 9 1 38	2 14	2 59	3 51	4 54	6 7	7 32	9 8	10 58	13 0			
55	9 17	30 47	1 10 1 40	2 17	3 3	3 57	5 2	6 17	7 44	9 23	11 15	13 21			
50	9 17	29 46	1 9 1 39	2 15	2 59	3 53	4 56	6 9	7 34	9 12	11 2	13 5			
45	8 16	27 43	1 5 1 32	2 6	2 48	3 39	4 37	5 46	7 6	8 37	10 20	12 16			
40	7 14	24 39	58 1 22	1 53	2 30	3 15	4 8	5 10	6 21	7 43	9 15	10 5			
35	6 12	21 33	49 1 10	1 36	2 8	2 46	3 31	4 24	5 25	6 34	7 53	9 21			
30	5 10	17 27	40 56	1 17	1 43	2 14	2 50	3 32	4 21	5 17	6 20	7 3			
25	4 7	13 20	30 42	58 1 17	1 40	2 7	2 39	3 15	3 57	4 44	5 3				
20	3 5	9 14	20 29	39 52	1 8	1 26	1 48	2 12	2 41	3 13	3 4				
15	2 3	5 8	12 17	23 31	40 51	1 3	1 18	1 35	1 53	2 1					
10	7 1	2 4	5 8 11	13 18	23 29	36 43	52	56	60	64	68	72	76	80	84
5	2 3	6 9 1	2 3 4	5 4	6 5	7 6	8 7	9 8	10 9	11 10	12 11	13 10	14 9	15 8	16 7

* For observations near Prime Vertical Latitude of Place is the argument. For observations near Maximum Azimuth Declination of Star is the Argument.

TABLE III.

HOUR ANGLES AND ZENITH DISTANCES

AT

MAXIMUM AZIMUTH

(For Finding First, or Principal, Correction).

APPROXIMATE LIMITS OF ZENITH DISTANCE 30° TO 80° .

TABLE III.
ELEMENTS OF STARS AT MAXIMUM AZIMUTH
(ANGLE OF POSITION = 90°).

α ANDROMEDA (DECLINATION 28° 34' N.)

LATITUDE From 24° 20' N. to 4° 40' N.	Seconds of Time for change of one degree of Zenith Distance		LATITUDE From 24° 20' N. to 4° 20' N.	Seconds of Time for change of one degree of Zenith Distance	
	273.3s (a)	Change of Zenith Distance per minute of Time 15.17' (b)		273.3s (a)	Change of Zenith Distance per minute of Time 13.17' (b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
0 /	h m s	o' "	0 /	h m s	o' "
24 20	2 15 22	30 29 30	14 20	4 8 3	58 49 15
0	20 34	31 43 30	0	10 59	59 36 30
23 40	25 34	32 55 0	13 40	13 54	60 23 15
20	30 25	34 4 30	20	16 47	61 10 0
0	35 6	35 12 15	0	19 39	56 15
22 40	39 39	36 18 0	12 40	22 29	62 42 15
20	44 4	37 22 30	20	25 18	63 28 0
0	48 22	38 25 45	0	28 5	64 13 45
21 40	52 34	39 27 30	11 40	30 51	59 0
20	56 40	40 28 0	20	33 36	65 44 0
0	3 0 40	41 27 30	0	36 20	66 29 0
20 40	4 35	42 26 0	10 40	39 3	67 13 30
20	8 26	43 23 30	20	41 44	58 0
0	12 12	44 20 15	0	44 25	68 42 30
19 40	15 53	45 16 0	9 40	47 5	69 26 30
20	19 31	46 11 0	20	49 43	70 10 30
0	23 5	47 5 30	0	52 21	54 15
18 40	26 36	59 0	8 40	54 58	71 38 0
20	30 3	48 52 0	20	57 34	72 21 30
0	33 27	49 44 30	0	5 0 10	73 4 45
17 40	36 48	50 36 15	7 40	2 45	48 0
20	40 6	51 27 45	20	5 19	74 31 0
0	43 21	52 18 30	0	7 52	75 14 0
16 40	46 34	53 9 0	6 40	10 25	75 57 0
20	49 45	58 30	20	12 57	76 39 45
0	52 53	54 48 0	0	15 29	77 22 30
15 40	55 59	55 37 0	5 40	18 0	78 5 0
20	59 3	56 25 30	20	20 31	47 30
0	4 2 5	57 13 45	0	23 1	79 30 0
14 40	5 5	58 1 45	4 40	25 31	80 12 15

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—Continued.

ELEMENTS OF STARS AT MAXIMUM AZIMUTH.

(ANGLE OF POSITION = 90°).

α ARIETIS (DECLINATION 23° 1' N.)

LATITUDE from 19° 40' N. to 3° 40' N.	Seconds of Time for change of one degree of Zenith Distance 260'8s (a)	Change of Zenith Distance per minute of Time 13'81 (b)	LATITUDE from 19° 40' N. to 3° 40' N.	Seconds of Time for change of one degree of Zenith Distance 260'8s (a)	Change of Zenith Distance per minute of Time 13'81 (b)							
°	°	°	°	°	°	'	'	"	'	"	'	"
19 40	2 10 54	30 36 0	11 20	4 7 24	59 49 45							
20	17 18	32 8 45	0	11 5	60 47 30							
0	23 25	33 37 45										
18 40	29 17	35 3 30	10 40	14 44	61 44 45							
20	34 57	36 26 30	20	18 20	62 41 30							
0	40 26	37 47 0	0	21 54	63 38 0							
17 40	45 44	39 5 15	9 40	25 27	64 34 0							
20	50 53	40 21 45	20	28 57	65 29 45							
0	55 53	41 36 15	0	32 26	66 25 0							
16 40	3 0 46	42 49 0	8 40	35 54	67 20 0							
20	5 32	44 0 30	20	39 19	68 14 30							
0	10 11	45 10 30	0	42 43	69 9 0							
15 40	14 45	46 19 15	7 40	46 6	70 3 0							
20	19 12	47 26 45	20	49 28	70 56 45							
0	23 35	48 33 0	0	52 48	71 50 15							
14 40	27 53	49 38 30	6 40	56 7	72 43 45							
20	32 6	50 43 0	20	59 25	73 36 45							
0	36 15	51 46 30	0	5 2 42	74 29 45							
13 40	40 20	52 49 15	5 40	5 58	75 22 15							
20	44 22	53 51 30	20	9 13	76 14 45							
0	48 19	54 52 45	0	12 28	77 7 15							
12 40	52 14	55 53 15	4 40	15 41	77 59 30							
20	56 6	56 53 15	20	18 54	78 51 30							
0	59 54	57 52 30	0	22 6	79 43 30							
11 40	4 3 40	58 51 30	3 40	25 18	80 35 15							

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—*Continued.*
 ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
 (ANGLE OF POSITION = 90°).

ALDEBARAN (DECLINATION 16° 19' N.).

LATITUDE From 14° N. to 2° 40' N.	Seconds of Time for change of one degree of Zenith Distance 250·1s (a)	Change of Zenith Distance per minute of Time 14·4' (b)	LATITUDE From 14° N. to 2° 40' N.	Seconds of Time for change of one degree of Zenith Distance 250·1s (a)	Change of Zenith Distance per minute of Time 14·4' (b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
14 0	2 6 24	30 33 30	8 0	4 5 14	60 18 15
13 40	15 21	32 45 15	7 40	10 30	61 39 0
20	23 46	34 49 45	20	15 41	62 58 45
0	31 46	36 48 15	0	20 48	64 17 30
12 40	39 23	38 41 30	6 40	25 52	65 35 30
20	46 43	40 30 45	20	30 53	66 52 45
0	53 45	42 16 0	0	35 50	68 9 30
11 40	3 0 34	43 57 45	5 40	40 45	69 25 30
20	7 10	45 37 0	20	45 37	70 40 45
0	13 34	47 13 15	0	50 27	71 55 45
10 40	19 49	48 47 15	4 40	55 14	73 10 0
20	25 54	50 19 15	20	5 0 0	74 24 0
0	31 51	51 49 30	0	4 43	75 37 30
9 40	37 40	53 17 45	3 40	9 25	76 50 30
20	43 23	54 44 30	20	14 6	78 3 15
0	48 59	56 9 45	0	18 45	79 15 45
8 40	54 29	57 33 45	2 40	23 23	80 28 0
20	59 54	58 56 45			

BETELGEUSE (DECLINATION 7° 23' N.).

LATITUDE From 6° 20' N. to 1° 20' N.	Seconds of Time for change of one degree of Zenith Distance 242·0s (a)	Change of Zenith Distance per minute of Time 14·88' (b)	LATITUDE From 6° 20' N. to 1° 20' N.	Seconds of Time for change of one degree of Zenith Distance 242·0s (a)	Change of Zenith Distance per minute of Time 14·88' (b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
6 20	2 4 17	30 51 45	3 40	4 1 27	60 9 15
0	23 11	35 34 15	20	13 10	63 6 0
5 40	40 6	39 47 30	0	24 35	65 58 0
20	55 38	43 40 15	2 40	35 44	68 46 30
0	3 10 8	47 17 45	20	46 41	71 31 45
4 40	23 49	50 43 15	0	57 28	74 14 30
20	36 51	53 59 15	1 40	5 8 6	76 55 15
0	49 22	57 7 30	20	18 37	79 34 0

(a) For use in finding *Hour Angle* from *Zenith Distance*.

(b) For use in finding *Zenith Distance* from *Hour Angle*.

TABLE III.—*Continued.*

ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
(ANGLE OF POSITION = 90°).

POLLUX (DECLINATION 28° 15' N.).

LATITUDE from 24° N. to 4° 40' N.	Seconds of Time for change of one degree of Zenith Distance		LATITUDE from 24° N. to 4° 20' N.	Seconds of Time for change of one degree of Zenith Distance	
	272' 5s (a)	Change of Zenith Distance per minute of Time 13' 21' (b)		272' 5s (q)	Change of Zenith Distance per minute of Time 13' 21' (b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance
0°	h m s	° ' "	0°	h m s	° ' "
24 0	2 16 10	30 45 30	14 0	4 9 25	59 15 45
23 40	2 21 23	31 59 45	13 40	12 22	60 3 15
20	26 24	33 11 45	20	15 18	60 50 30
0	31 16	34 21 30	0	18 13	61 37 30
22 40	35 58	35 29 30	12 40	21 6	62 24 0
20	40 32	36 36 0	20	23 57	63 10 30
0	44 58	37 40 45	0	26 47	63 56 30
21 40	49 17	38 44 15	11 40	29 36	64 42 30
20	53 30	39 46 15	20	32 24	65 28 15
0	57 37	40 47 15	0	35 10	66 13 30
20 40	3 1 39	41 47 0	10 40	37 55	66 58 45
20	5 35	42 46 0	20	40 39	67 43 45
0	9 27	43 43 45	0	43 22	68 28 45
19 40	13 14	44 40 45	9 40	46 4	69 13 15
20	16 56	45 37 0	20	48 45	69 57 45
0	20 35	46 32 30	0	51 26	70 42 0
18 40	24 10	47 27 15	8 40	54 5	71 26 15
20	27 42	48 21 15	20	56 43	72 10 15
0	31 10	49 14 30	0	59 21	72 54 0
17 40	34 35	50 7 15	7 40	5 1 58	73 37 45
20	37 57	50 59 30	20	4 34	74 21 15
0	41 17	51 51 0	0	7 10	75 4 45
16 40	44 33	52 42 15	6 40	9 45	75 48 0
20	47 48	53 32 45	20	12 19	76 31 15
0	50 59	54 23 0	0	14 53	77 14 30
15 40	54 9	55 12 45	5 40	17 26	77 57 30
20	57 16	56 2 15	20	19 59	78 40 30
0	4 0 21	56 51 0	0	22 31	79 23 15
14 40	3 24	57 39 45	4 40	25 3	80 6 15
20	6 25	58 27 45			

- (a) For use in finding *Hour Angle* from *Zenith Distance*.
- (b) For use in finding *Zenith Distance* from *Hour Angle*.

TABLE III.—*Continued.*
 ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
 (ANGLE OF POSITION = 90°).

REGULUS (DECLINATION 12° 26' N.)

LATITUDE from 10° 40' N. to 2° 20' N.	Seconds of Time for change of one degree of Zenith Distance 245° 7'		LATITUDE from 10° 40' N. to 2° 20' N.	Seconds of Time for change of one degree of Zenith Distance 245° 7'	
	(a)	(b)		(a)	(b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
10 40	2 5 16	30 43 0	6 20	3 59 6	59 10 45
20	16 50	33 34 45	0	4 6 7	60 57 15
0	27 34	36 14 30	5 40	13 1	62 42 15
9 40	37 39	38 45 0	20	19 48	64 25 30
20	47 12	41 7 30	0	26 29	66 7 15
0	56 19	43 24 0	4 40	33 5	67 47 45
8 40	3 5 3	45 35 0	20	39 36	69 27 15
20	13 28	47 41 15	0	46 2	71 5 45
0	21 36	49 43 45	3 40	52 25	72 43 15
7 40	29 29	51 42 45	20	58 44	74 20 0
20	37 9	53 38 30	0	5 5 0	75 56 0
0	44 38	55 31 30	2 40	11 13	77 31 15
6 40	51 56	57 22 15	20	17 24	79 6 0

β LEONIS (DECLINATION 15° 7' N.)

LATITUDE from 13° N. to 2° 20' N.	Seconds of Time for change of one degree of Zenith Distance 248° 6'		LATITUDE from 13° N. to 2° 20' N.	Seconds of Time for change of one degree of Zenith Distance 248° 6'	
	(a)	(b)		(a)	(b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
13 0	2 5 7	30 23 30	7 20	4 6 12	60 41 45
12 40	14 47	32 46 15	0	11 52	62 8 30
20	23 51	35 0 30	6 40	17 27	63 34 0
0	32 26	37 8 0	20	22 58	64 58 30
11 40	40 36	39 9 30	0	28 25	66 22 15
20	48 25	41 6 0	5 40	33 48	67 45 0
0	55 55	42 58 30	20	39 8	69 7 15
10 40	3 3 10	44 47 0	0	44 25	70 28 30
20	10 12	46 32 30	4 40	49 39	71 49 15
0	17 0	48 15 0	20	54 50	73 9 30
9 40	23 38	49 55 0	0	59 59	74 29 0
20	30 6	51 32 45	3 40	5 5 6	75 48 15
0	36 25	53 8 30	20	10 12	77 7 0
8 40	42 36	54 42 0	0	15 15	78 25 30
20	48 39	56 14 0	2 40	20 17	79 43 30
0	54 36	57 44 45	20	25 18	81 1 0
7 40	4 0 27	59 14 0			

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—(Continued.)

ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
(ANGLE OF POSITION = 90°).

ARCTURUS (DECLINATION 19° 41' N.)

LATITUDE from 16° 40' N. to 3° 20' N.	Seconds of Time for change of one degree in Zenith Distance. 254.9 (a)	Change of Zenith Distance per minute of Time. 14'12' (b)	LATITUDE from 16° 40' N. to 3° 20' N.	Seconds of Time for change of one degree in Zenith Distance. 254.9 (a)	ARCTURUS (DECLINATION 19° 41' N.)	
					Hour Angle.	Zenith Distance.
16 40	2 12 45	31 37 30	9 40	4 6 16	60 5 45	
20	19 59	33 23 30	20	10 36	61 13 0	
0	26 53	35 4 45	0	14 53	62 19 30	
15 40	33 29	36 42 15	8 40	19 7	63 25 30	
20	39 50	38 16 15	20	23 19	64 31 15	
0	45 58	39 47 15	0	27 28	65 35 45	
14 40	51 54	41 15 45	7 40	31 35	66 40 0	
20	57 40	42 41 30	20	35 40	67 43 45	
0	3 3 15	44 5 30	0	39 42	68 47 15	
13 40	8 42	45 27 15	6 40	43 43	69 50 15	
20	14 2	46 47 15	20	47 42	70 53 0	
0	19 13	48 5 45	0	51 39	71 55 15	
12 40	24 19	49 23 0	5 40	55 35	72 57 15	
20	29 17	50 38 30	20	59 29	73 58 45	
0	34 11	51 53 0	0	5 3 22	75 0 15	
11 40	38 59	53 6 15	4 40	7 14	76 1 15	
20	43 42	54 18 30	20	11 5	77 2 15	
0	48 21	55 29 30	0	14 55	78 2 45	
10 40	52 55	56 40 0	3 40	18 43	79 3 15	
20	57 25	57 49 15	20	22 31	80 3 30	
0	4 1 52	58 58 0				

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—*Continued.*

ELEMENTS OF STARS AT MAXIMUM AZIMUTH.

(ANGLE OF POSITION = 90°).

α CORONÆ (DECLINATION 27° 2' N.).

LATITUDE from 23° N. to 4° 20' N.	Seconds of Time for change of one degree in Zenith Distance 269° 4' (a)		LATITUDE from 23° N. to 4° 20' N.	Seconds of Time for change of one degree in Zenith Distance 269° 4' (a)	
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
23 0	2 14 50	30 43 15	13 20	4 9 18	59 30 30
22 40	20 17	32 1 0	0	12 24	60 20 0
20	25 31	33 16 30	12 40	15 28	61 9 15
0	30 35	34 29 30	20	18 31	58 0
21 40	35 29	35 40 30	0	21 32	62 46 45
20	40 14	36 49 45	11 40	24 31	63 35 0
0	44 51	37 57 30	20	27 29	64 23 0
20 40	49 20	39 3 30	0	30 26	65 10 45
20	53 43	40 8 15	10 40	33 21	58 0
0	57 59	41 11 30	20	36 15	66 45 15
19 40	3 2 9	42 13 45	0	39 8	67 32 15
20	6 14	43 14 45	9 40	42 0	68 19 0
0	10 15	44 15 0	20	44 50	69 5 45
18 40	14 10	45 14 15	0	47 40	52 0
20	18 1	46 12 30	8 40	50 29	70 38 15
0	21 47	47 10 0	20	53 16	71 24 15
17 40	25 30	48 6 30	0	56 3	72 10 15
20	29 10	49 2 30	7 40	58 49	55 45
0	32 46	57 45	20	5 1 34	73 41 30
16 40	36 18	50 52 30	0	4 18	74 26 45
20	39 47	51 46 30	6 40	7 2	75 12 0
0	43 14	52 40 0	20	9 45	57 15
15 40	46 38	53 33 0	0	12 27	76 42 15
20	49 59	54 25 15	5 40	15 9	77 27 15
0	53 18	55 17 15	20	17 50	78 12 0
14 40	56 34	56 8 45	0	20 31	56 45
20	59 48	59 45	4 40	23 11	79 41 15
0	4 3 0	57 50 30	20	25 50	80 25 45
13 40	6 10	58 40 45			

(a) For use in finding *Hour Angle* from *Zenith Distance*.(b) For use in finding *Zenith Distance* from *Hour Angle*.

TABLE III.—Continued.
ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
(ANGLE OF POSITION = 90°).

ALTAIR (DECLINATION 8° 37' N.).

LATITUDE from 7° 20' N. to 1° 20' N.	Seconds of Time for change of one degree of Zenith Distance		LATITUDE from 7° 20' N. to 1° 20' N.	Seconds of Time for change of one degree of Zenith Distance	
	242.7s (a)	14' 33' (b)		242.7s (a)	14' 33' (b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
°	h m s	° ' "	°	h m s	° ' "
7 20	2 7 28	31 34 30	4 0	4 10 4	62 15 0
0	23 30	35 34 0	3 40	19 56	64 44 0
6 40	38 6	39 12 30	20	29 35	67 9 45
20	51 38	42 35 0	0	39 4	69 33 15
0	3 4 20	45 45 30	2 40	48 24	71 54 30
5 40	16 23	48 46 15	20	57 36	74 14 0
20	27 53	51 39 15	0	5 6 42	76 31 45
0	38 56	54 25 45	1 40	15 43	78 48 15
4 40	49 37	57 6 30	20	24 39	81 4 C
20	59 59	59 42 45			

MARKAB (DECLINATION 14° 42' N.).

LATITUDE from 12° 40' N. to 2° 40' N.	Seconds of Time for change of one degree of Zenith Distance		LATITUDE from 12° 40' N. to 2° 40' N.	Seconds of Time for change of one degree of Zenith Distance	
	248.1s (a)	14' 51' (b)		248.1s (a)	14' 51' (b)
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
°	h m s	° ' "	°	h m s	° ' "
12 40	2 4 13	30 13 0	7 20	4 2 30	59 48 0
20	14 11	32 40 30	0	8 22	61 17 45
0	23 32	34 59 0	6 40	14 10	62 46 30
11 40	32 21	37 10 0	20	19 53	64 14 0
20	40 44	39 14 45	0	25 32	65 40 30
0	48 45	41 14 30	5 40	31 6	67 6 0
10 40	56 28	43 9 45	20	36 37	68 30 45
20	3 3 53	45 1 15	0	42 5	69 54 45
0	11 5	46 49 15	4 40	47 29	71 18 0
9 40	18 3	48 34 15	20	52 51	72 40 30
20	24 50	50 16 30	0	58 10	74 2 45
0	31 27	51 56 30	3 40	5 3 27	75 24 15
8° 40'	37 55	53 34 15	20	8 41	76 45 15
20	44 14	55 10 15	0	13 54	78 5 45
0	50 26	56 44 15	2 40	19 6	79 26 0
7 40	56 31	58 17 0			

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—*Continued.*
ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
(ANGLE OF POSITION = 90°).

RIGEL (DECLINATION 8° 19' S.)

LATITUDE, from 7° S. to 1° 20' S.	Seconds of Time for change of one degree in Zenith Distance		LATITUDE, from 7° S. to 1° 20' S.	Seconds of Time for change of one degree in Zenith Distance		Change of Zenith Distance per minute of Time. 14° 84'
	242 6° (a)	32 35 30 (b)		242 6° (a)	32 35 30 (b)	
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.	
7 0	2 11 28	32 35 30	4 0	4 5 41	61 10 0	
6 40	27 38	36 37 0	3 40	16 0	63 45 30	
20	42 24	40 18 0	20	26 5	66 17 30	
0	56 7	43 43 30	0	35 58	68 47 15	
5 40	3 9 0	46 57 0	2 40	45 41	71 14 15	
20	21 15	50 0 45	20	55 16	73 39 0	
0	32 57	52 56 45	0	5 4 43	76 2 15	
4 40	44 13	55 46 15	1 40	14 4	78 24 0	
20	55 7	58 30 30	20	23 21	80 44 30	

SIRIUS (DECLINATION 16° 35' S.)

LATITUDE from 14° 20' S. to 2° 40' S.	Seconds of Time for change of one degree in Zenith Distance		LATITUDE from 14° 20' S. to 2° 40' S.	Seconds of Time for change of one degree in Zenith Distance		Change of Zenith Distance per minute of Time. 14° 38'
	250 4° (a)	32 2 45 (b)		250 4° (a)	32 2 45 (b)	
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.	
14 20	2 3 37	29 50 30	8 20	4 2 9	59 29 0	
0	12 36	32 2 45	0	7 22	60 49 0	
13 40	21 3	34 7 15	7 40	12 30	62 8 0	
20	29 3	36 5 45	20	17 35	63 26 0	
0	36 41	37 59 0	0	22 36	64 43 15	
12 40	44 0	39 48 0	6 40	27 34	66 0 0	
20	51 2	41 33 0	20	32 28	67 15 45	
0	57 50	43 14 30	0	37 20	68 31 0	
11 40	3 4 25	44 53 15	5 40	42 9	69 45 30	
20	10 48	46 29 0	20	46 55	70 59 30	
0	17 1	48 2 45	0	51 40	72 13 15	
10 40	23 4	49 34 15	4 40	56 22	73 26 15	
20	28 59	51 3 45	20	5 1 2	74 39 0	
0	34 46	52 31 30	0	5 41	75 51 15	
9 40	40 27	53 57 45	3 40	10 18	77 3 0	
20	46 1	55 22 30	20	14 53	78 14 45	
0	51 29	56 45 45	0	19 27	79 26 0	
8 40	56 51	58 8 0	2 40	24 0	80 37 0	

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—*Continued.*
 ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
 (ANGLE OF POSITION=90°).

α HYDRA (DECLINATION 8° 15' S.).

LATITUDE from 7° S. to 1° 20' S.	Seconds of Time for change of one degree in Zenith Distance 242° 5' (a)		LATITUDE from 7° S. to 1° 20' S.	Seconds of Time for change of one degree in Zenith Distance 242° 5' (a)			
	Change of Zenith Distance per minute of Time 14° 85' (b)			Hour Angle.		Zenith Distance.	
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.		
	h m s	° ' "		h m s	° ' "		
7 0	2 8 32	31 51 45	4 0	4 4 40	60 54 45		
6 40	25 7	35 59 45	3 40	15 5	63 32 0		
20	40 12	39 45 30	20	25 16	66 5 45		
0	54 10	43 14 30	0	35 15	68 36 30		
5 40	3 7 16	46 31 0	2 40	45 3	71 4 45		
20	19 41	49 37 30	20	54 43	73 31 0		
0	31 33	52 36 0	0	5 4 15	75 55 30		
4 40	42 57	55 27 30	1 40	13 42	78 18 15		
20	53 58	58 13 30	20	23 3	80 40 0		

SPICA (DECLINATION 10° 40' S.).

LATITUDE from 9° S. to 1° 40' S.	Seconds of Time for change of one degree in Zenith Distance 244° 2' (a)		LATITUDE from 9° S. to 1° 40' S.	Seconds of Time for change of one degree in Zenith Distance 244° 2' (a)			
	Change of Zenith Distance per minute of Time 14° 74' (b)			Hour Angle.		Zenith Distance.	
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.		
	h m s	° ' "		h m s	° ' "		
9 0	2 11 4	32 18 45	5 0	4 9 17	61 54 30		
8 40	23 54	35 30 0	4 40	17 16	63 55 30		
20	35 48	38 27 45	20	25 7	65 54 30		
0	46 58	41 14 45	0	32 50	67 51 30		
7 40	57 32	43 53 0	3 40	40 26	69 47 15		
20	3 7 36	46 24 0	20	47 57	71 41 30		
0	17 16	48 49 15	0	55 23	73 34 30		
6 40	26 34	51 9 15	2 40	5 2 44	75 26 30		
20	35 35	53 25 0	20	10 1	77 17 30		
0	44 19	55 37 0	0	17 16	79 8 0		
5 40	52 50	57 45 30	1 40	24 27	80 57 30		
20	4 1 9	59 51 15					

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—(Continued.)

ELEMENTS OF STARS AT MAXIMUM AZIMUTH.
(ANGLE OF POSITION = 90°).

ANTARES (DECLINATION 26° 13' S.).

LATITUDE from 22° 20' S. to 4° 20' S.	Seconds of Time for change of one degree in Zenith Distance. 267.5 ^a		LATITUDE from 22° 20' S. to 4° 20' S.	Seconds of Time for change of one degree in Zenith Distance. 267.5 ^a	
	Hour Angle.	Zenith Distance.		Hour Angle.	Zenith Distance.
22 20	2 13 51	30 39 45	12 40	4 11 23	60 14 30
0	19 28	32 0 30	20	14 33	61 5 0
21 40	24 52	33 18 15	0	17 43	55 30
20	30 5	34 33 45	11 40	20 50	62 45 30
0	35 8	35 47 0	20	23 56	63 35 15
20 40	40 1	36 58 30	0	27 0	64 24 30
20	44 45	38 8 0	10 40	30 3	65 13 45
0	49 22	39 16 0	20	33 4	66 2 30
19 40	53 52	40 22 30	0	36 4	51 15
20	58 15	41.27 45	20	39 3	67 39 30
0	3 2 32	42 31 30	9 40	42 1	68 27 45
18 40	6 43	43 34 15	0	44 57	69 15 45
20	10 50	44 36 0	8 40	47 52	70 3 15
0	14 51	45 36 45	20	50 47	51 0
17 40	18 48	46 36 30	0	53 40	71 38 15
20	22 40	47 35 30	20	56 32	72 25 15
0	26 29	48 33 45	7 40	59 24	73 12 15
16 40	30 14	49 31 0	20	5 2 15	59 15
20	33 55	50 27 45	0	5 5	74 45 45
0	37 33	51 23 45	6 40	7 54	75 32 30
15 40	41 7	52 19 0	20	10 42	76 18 45
20	44 39	53 14 0	0	13 30	77 5 0
0	48 8	54 8 0	5 40	16 17	51 15
14 40	51 34	55 1 45	20	19 4	78 37 15
20	54 58	55 0	0	21 50	79 23 15
0	58 19	56 47 45	4 40	24 36	80 9 0
13 40	4 1 38	57 40 0	20		
20	4 55	58 32 0			
0	8 10	59 23 15			

^(a) For use in finding Hour Angle from Zenith Distance.^(b) For use in finding Zenith Distance from Hour Angle.

TABLE III.—*Continued.*
 ELEMENTS OF STARS AT MAXIMUM AZIMUTH
 (ANGLE OF POSITION = 90°)

FOMALHAUT (DECLINATION 30° 8' S.)

LATITUDE from 25° 40' S. to 5° S.	Seconds of Time for change of one degree of Zenith Distance 277 5 ^s (a)		Change of Zenith Distance per minute of Time 12 97' (b)	LATITUDE from 25° 40' S. to 5° S.	Seconds of Time for change of one degree of Zenith Distance 277 5 ^s (a)		Change of Zenith Distance per minute of Time 12 97' (b)
	Hour	Angle			Zenith Distance	Hour	
25 40	2 16	28	30 22 0	15 0	4 10 2	58 58 0	
20	21 25	0	31 32 0	14 40	12 48	59 42 45	
0	26 12	0	32 40 0	20	15 32	60 27 15	
24 40	30 49	0	33 46 0	0	18 15	61 11 30	
20	35 18	15	34 50 15	13 40	20 56	55 30	
0	39 39	0	35 53 0	20	23 36	62 39 15	
23 40	43 53	0	36 54 30	0	26 15	63 22 45	
20	48 0	30	37 54 30	12 40	28 53	64 6 0	
0	52 2	30	38 53 30	20	31 29	49 0	
22 40	55 57	30	39 51 30	0	34 5	65 32 0	
20	59 48	15	40 48 15	11 40	36 39	66 14 45	
0	3 3 33	15	41 44 15	20	39 12	57 15	
21 40	7 14	15	42 39 15	0	41 44	67 39 45	
20	10 51	30	43 33 30	10 40	44 16	68 21 45	
0	14 24	0	44 27 0	20	46 46	69 4 0	
20 40	17 53	45	45 19 45	0	49 16	45 45	
20	21 18	45	46 11 45	9 40	51 45	70 27 30	
0	24 40	45	47 3 15	20	54 12	71 9 15	
19 40	27 59	15	54 15	0	56 40	50 30	
20	31 15	30	48 44 30	8 40	59 6	72 32 0	
0	34 28	15	49 34 15	20	5 1 32	73 13 15	
18 40	37 38	30	50 23 30	0	3 57	54 15	
20	40 45	15	51 12 15	7 40	6 22	74 35 15	
0	43 50	30	52 0 30	20	8 46	75 16 15	
17 40	46 53	15	48 15	0	11 9	57 0	
20	49 54	45	53 35 45	6 40	13 32	76 37 45	
0	52 52	45	54 22 45	20	15 54	77 18 15	
16 40	55 48	30	55 9 30	0	18 16	59 0	
20	58 43	45	55 45	5 40	20 38	78 39 30	
0	4 1 35	45	56 41 45	20	22 59	79 19 45	
15 40	4 26	30	57 27 30	0	25 19	80 0 15	
20	7 15	45	58 12 45				

(a) For use in finding Hour Angle from Zenith Distance.

(b) For use in finding Zenith Distance from Hour Angle.

TABLE IV.

RATE OF CHANGE OF ALTITUDE
(IN MINUTES) PER MINUTE OF TIME
(For Finding Reduction to Meridian).

LIMITS—AZIMUTH $0^\circ 30'$ to 10° , LATITUDE 0° to 60° .

TABLE IV.
RATE OF CHANGE OF ALTITUDE PER MINUTE OF TIME.

Azimuth	LATITUDE.												Azimuth
	0 0	0 30	1 0	1 30	2 0	2 30	3 0	3 30	4 0	4 30	5 0	5 30	
0 30	131	131	131	131	131	131	131	131	131	131	130	130	0 30
1 0	262	262	262	262	262	262	261	261	261	261	261	261	1 0
30	393	393	393	393	392	392	392	392	392	391	391	391	30
2 0	523	523	523	523	523	523	523	523	522	522	522	521	2 0
30	654	654	654	654	654	654	653	653	653	652	652	651	30
3 0	785	785	785	785	785	784	784	784	783	783	782	781	3 0
30	916	916	916	915	915	915	915	914	914	913	912	912	30
4 0	1 047	1 047	1 046	1 046	1 046	1 045	1 045	1 044	1 044	1 043	1 042	1 042	4 0
30	1 177	1 177	1 177	1 176	1 176	1 175	1 175	1 174	1 173	1 172	1 172	1 171	30
5 0	1 307	1 307	1 307	1 307	1 306	1 306	1 306	1 305	1 304	1 303	1 302	1 301	5 0
30	1 438	1 438	1 437	1 437	1 437	1 436	1 436	1 435	1 434	1 433	1 432	1 431	30
6 0	1 568	1 568	1 568	1 567	1 567	1 566	1 566	1 565	1 564	1 563	1 562	1 561	6 0
30	1 698	1 698	1 698	1 697	1 697	1 696	1 696	1 695	1 694	1 693	1 692	1 690	30
7 0	1 828	1 828	1 828	1 827	1 827	1 826	1 826	1 825	1 824	1 822	1 821	1 820	7 0
30	1 958	1 958	1 958	1 957	1 957	1 956	1 955	1 954	1 953	1 952	1 950	1 949	30
8 0	2 088	2 088	2 087	2 086	2 086	2 086	2 085	2 084	2 083	2 081	2 080	2 078	8 0
30	2 217	2 217	2 217	2 216	2 216	2 215	2 214	2 213	2 212	2 210	2 209	2 207	30
9 0	2 346	2 346	2 346	2 345	2 345	2 344	2 343	2 342	2 341	2 339	2 338	2 336	9 0
30	2 476	2 476	2 475	2 475	2 474	2 473	2 472	2 471	2 470	2 468	2 466	2 464	30
10 0	2 605	2 605	2 604	2 603	2 603	2 602	2 601	2 600	2 598	2 597	2 595	2 593	10 0

Azimuth	LATITUDE.												Azimuth
	6 0	6 30	7 0	7 30	8 0	8 30	9 0	9 30	10 0	10 30	11 0	11 30	
0 30	130	130	130	130	130	130	129	129	129	129	129	128	0 30
1 0	260	260	260	260	259	259	259	258	258	257	257	257	1 0
30	391	390	390	389	389	388	388	387	387	386	385	385	30
2 0	521	520	520	519	518	518	517	516	516	515	514	513	2 0
30	651	650	649	649	648	647	646	645	644	643	642	641	30
3 0	781	780	779	778	777	776	775	774	773	772	771	769	3 0
30	911	910	909	908	907	906	905	903	902	900	899	897	30
4 0	1 041	1 040	1 039	1 037	1 036	1 035	1 033	1 032	1 030	1 029	1 027	1 025	4 0
30	1 170	1 169	1 168	1 167	1 165	1 164	1 162	1 161	1 159	1 157	1 155	1 153	30
5 0	1 300	1 299	1 298	1 296	1 295	1 293	1 291	1 289	1 287	1 285	1 283	1 281	5 0
30	1 430	1 428	1 427	1 425	1 424	1 422	1 420	1 418	1 416	1 414	1 411	1 409	30
6 0	1 559	1 558	1 556	1 555	1 553	1 551	1 549	1 546	1 544	1 542	1 539	1 536	6 0
30	1 689	1 687	1 685	1 684	1 682	1 679	1 677	1 675	1 672	1 670	1 667	1 664	30
7 0	1 818	1 816	1 814	1 812	1 810	1 808	1 806	1 803	1 800	1 797	1 794	1 791	7 0
30	1 947	1 945	1 943	1 941	1 939	1 936	1 934	1 931	1 928	1 925	1 922	1 919	30
8 0	2 076	2 074	2 072	2 070	2 067	2 065	2 062	2 059	2 056	2 053	2 049	2 046	8 0
30	2 205	2 203	2 201	2 198	2 196	2 193	2 190	2 187	2 183	2 180	2 176	2 173	30
9 0	2 334	2 331	2 329	2 326	2 324	2 321	2 318	2 314	2 311	2 307	2 303	2 299	9 0
30	2 462	2 460	2 457	2 454	2 452	2 449	2 445	2 442	2 438	2 434	2 430	2 426	30
10 0	2 590	2 588	2 585	2 582	2 578	2 576	2 573	2 569	2 566	2 561	2 557	2 552	10 0

TABLE IV.—Continued.

RATE OF CHANGE OF ALTITUDE PER MINUTE OF TIME.

Azimuth	LATITUDE.												Azimuth
	12 0	12 30	13 0	13 30	14 0	14 30	15 0	15 30	16 0	16 30	17 0	17 30	
0 30	.128	.128	.128	.127	.127	.127	.126	.126	.126	.126	.125	.125	0 30
1 0	.256	.255	.254	.254	.253	.253	.252	.252	.251	.251	.250	.250	1 0
30	.384	.383	.383	.382	.381	.380	.379	.378	.377	.377	.376	.375	30
2 0	.512	.511	.510	.509	.508	.507	.506	.505	.503	.502	.501	.499	2 0
30	.640	.639	.638	.636	.635	.634	.633	.631	.629	.627	.626	.624	30
3 0	.768	.766	.765	.763	.762	.760	.758	.757	.755	.753	.751	.749	3 0
30	.896	.894	.892	.890	.889	.887	.885	.882	.880	.878	.876	.873	30
4 0	1.023	1.022	1.020	1.017	1.015	1.013	1.011	1.008	1.006	1.003	1.001	.998	4 0
30	1.151	1.149	1.147	1.144	1.142	1.139	1.137	1.134	1.134	1.128	1.125	1.122	30
5 0	1.279	1.276	1.274	1.272	1.269	1.266	1.263	1.260	1.257	1.254	1.250	1.247	5 0
30	1.406	1.404	1.401	1.398	1.395	1.392	1.389	1.385	1.382	1.378	1.375	1.371	30
6 0	1.534	1.531	1.528	1.525	1.521	1.518	1.515	1.511	1.507	1.503	1.499	1.495	6 0
30	1.661	1.658	1.655	1.651	1.648	1.644	1.640	1.636	1.632	1.628	1.624	1.619	30
7 0	1.788	1.785	1.781	1.778	1.774	1.770	1.766	1.762	1.757	1.753	1.748	1.743	7 0
30	1.915	1.911	1.908	1.904	1.900	1.896	1.891	1.887	1.882	1.877	1.872	1.867	30
8 0	2.042	2.038	2.034	2.030	2.026	2.021	2.016	2.012	2.007	2.002	1.996	1.991	8 0
30	2.169	2.165	2.160	2.156	2.151	2.147	2.142	2.137	2.131	2.126	2.120	2.115	30
9 0	2.295	2.291	2.286	2.282	2.277	2.272	2.267	2.261	2.256	2.250	2.244	2.238	9 0
30	2.422	2.417	2.412	2.407	2.402	2.397	2.391	2.386	2.380	2.374	2.368	2.361	30
10 0	2.548	2.543	2.538	2.533	2.527	2.522	2.516	2.510	2.504	2.497	2.491	2.484	10 0

Azimuth	LATITUDE.												Azimuth
	18 0	18 30	19 0	19 30	20 0	20 30	21 0	21 30	22 0	22 30	23 0	23 30	
0 30	.125	.124	.124	.123	.123	.123	.122	.122	.121	.121	.121	.120	0 30
1 0	.249	.248	.248	.247	.246	.245	.244	.244	.243	.242	.241	.240	1 0
30	.373	.372	.371	.370	.369	.368	.367	.365	.364	.363	.361	.360	30
2 0	.498	.496	.495	.494	.492	.490	.489	.487	.485	.484	.482	.480	2 0
30	.622	.621	.619	.617	.615	.613	.611	.609	.607	.605	.602	.600	30
3 0	.747	.745	.742	.740	.738	.735	.733	.730	.728	.725	.723	.720	3 0
30	.871	.868	.866	.863	.861	.858	.855	.852	.849	.846	.843	.840	30
4 0	.995	.992	.989	.986	.983	.980	.977	.974	.970	.967	.963	.960	4 0
30	1.119	1.116	1.113	1.109	1.106	1.102	1.099	1.095	1.091	1.087	1.083	1.079	30
5 0	1.243	1.240	1.236	1.232	1.228	1.224	1.221	1.216	1.212	1.208	1.203	1.199	5 0
30	1.367	1.363	1.359	1.355	1.351	1.347	1.342	1.338	1.333	1.328	1.323	1.318	30
6 0	1.491	1.487	1.483	1.478	1.473	1.469	1.464	1.459	1.454	1.449	1.443	1.438	6 0
30	1.615	1.610	1.606	1.601	1.596	1.591	1.585	1.580	1.574	1.569	1.563	1.557	30
7 0	1.739	1.734	1.728	1.723	1.718	1.712	1.707	1.701	1.695	1.689	1.683	1.676	7 0
30	1.862	1.857	1.851	1.846	1.840	1.834	1.828	1.822	1.815	1.809	1.802	1.796	30
8 0	1.985	1.980	1.974	1.968	1.962	1.955	1.949	1.942	1.936	1.929	1.922	1.914	8 0
30	2.109	2.103	2.096	2.090	2.083	2.077	2.070	2.063	2.056	2.048	2.041	2.033	30
9 0	2.232	2.225	2.219	2.212	2.205	2.198	2.191	2.183	2.176	2.168	2.160	2.152	9 0
30	2.356	2.348	2.341	2.334	2.326	2.319	2.311	2.303	2.295	2.287	2.279	2.270	30
10 0	2.477	2.470	2.463	2.455	2.448	2.440	2.432	2.423	2.415	2.406	2.398	2.389	10 0

TABLE IV.—Continued.

RATE OF CHANGE OF ALTITUDE PER MINUTE OF TIME.

Azimuth	LATITUDE.												Azimuth
	24° 0	24° 30	25° 0	25° 30	26° 0	26° 30	27° 0	27° 30	28° 0	28° 30	29° 0	29° 30	
0 30	120	119	119	118	118	117	117	116	116	115	115	114	0 30
1 0	239	238	237	236	235	234	233	232	231	230	229	228	1 0
30	359	357	356	354	353	351	350	348	347	345	343	342	30
2 0	478	476	474	473	471	469	466	464	462	460	458	456	2 0
30	598	595	593	591	588	586	583	580	578	575	572	570	30
3 0	717	714	712	709	706	703	700	696	693	690	687	683	3 0
30	837	833	830	827	823	820	816	812	809	805	801	797	30
4 0	956	952	948	944	940	936	932	928	924	920	915	911	4 0
30	1075	1071	1067	1062	1058	1053	1049	1044	1039	1034	1029	1024	30
5 0	1194	1190	1185	1180	1175	1170	1165	1160	1154	1149	1143	1138	5 0
30	1313	1308	1303	1298	1292	1287	1281	1275	1269	1263	1257	1251	30
6 0	1432	1427	1421	1415	1409	1403	1397	1391	1384	1378	1371	1365	6 0
30	1551	1545	1539	1533	1526	1520	1513	1506	1499	1492	1485	1478	30
7 0	1670	1663	1657	1650	1643	1636	1629	1621	1614	1607	1599	1591	7 0
30	1789	1782	1774	1767	1760	1752	1744	1737	1729	1721	1712	1704	30
8 0	1907	1900	1892	1884	1876	1868	1860	1852	1843	1835	1826	1817	8 0
30	2025	2018	2009	2001	1993	1984	1975	1967	1958	1948	1939	1930	30
9 0	2144	2135	2127	2118	2109	2100	2091	2081	2072	2062	2052	2042	9 0
30	2262	2253	2244	2235	2225	2216	2206	2196	2186	2176	2165	2155	30
10 0	2380	2370	2361	2351	2341	2331	2321	2310	2300	2289	2278	2267	10 0

Azimuth	LATITUDE.												Azimuth
	30° 0	30° 30	31° 0	31° 30	32° 0	32° 30	33° 0	33° 30	34° 0	34° 30	35° 0	35° 30	
0 30	113	113	112	112	111	110	110	109	109	108	107	107	0 30
1 0	227	226	224	223	222	221	220	218	217	216	214	213	1 0
30	340	338	337	335	333	331	329	327	326	324	322	320	30
2 0	453	451	449	446	444	442	439	437	434	431	429	426	2 0
30	567	564	561	558	555	552	549	546	542	539	536	533	30
3 0	680	677	673	669	666	662	658	655	651	647	643	639	3 0
30	793	789	785	781	777	772	768	764	759	755	750	746	30
4 0	906	902	897	892	887	883	878	873	868	862	857	852	4 0
30	1019	1014	1009	1003	998	993	987	981	976	970	964	958	30
5 0	1132	1126	1121	1115	1109	1103	1106	1100	1104	1108	1107	1101	1104
30	1245	1239	1232	1226	1219	1213	1206	1199	1192	1185	1178	1170	30
6 0	1358	1351	1344	1337	1330	1322	1315	1307	1300	1292	1284	1276	6 0
30	1471	1463	1456	1448	1440	1432	1424	1416	1408	1399	1391	1382	30
7 0	1583	1575	1567	1559	1550	1542	1533	1524	1516	1507	1497	1488	7 0
30	1696	1687	1678	1669	1660	1651	1642	1633	1623	1614	1604	1594	30
8 0	1808	1799	1789	1780	1770	1761	1751	1741	1731	1720	1710	1700	8 0
30	1920	1910	1900	1890	1880	1870	1859	1849	1838	1827	1816	1805	30
9 0	2032	2022	2011	2001	1990	1979	1968	1957	1946	1934	1922	1910	9 0
30	2144	2133	2122	2111	2100	2088	2076	2064	2052	2040	2028	2016	30
10 0	2256	2244	2233	2221	2209	2197	2185	2172	2159	2147	2134	2121	10 0

TABLE IV.—Continued.

RATE OF CHANGE OF ALTITUDE PER MINUTE OF TIME.

Azimuth	LATITUDE.												Azimuth
	36° 0'	36° 30'	37° 0'	37° 30'	38° 0'	38° 30'	39° 0'	39° 30'	40° 0'	40° 30'	41° 0'	41° 30'	
0° 30'	106	105	105	104	103	102	102	101	100	100	99	98	0° 30'
1° 0	212	210	209	208	206	205	203	202	201	199	198	196	1° 0
30	318	316	314	312	309	307	305	303	301	299	296	294	30
2° 0	424	421	418	415	413	410	407	404	401	398	395	392	2° 0
30	529	526	523	519	516	512	509	505	501	498	494	490	30
3° 0	635	631	627	623	619	614	610	606	601	597	592	588	3° 0
30	741	736	731	727	722	717	712	707	702	696	691	686	30
4° 0	847	841	836	830	825	819	813	807	802	796	790	784	4° 0
30	952	946	940	934	927	921	915	908	902	895	888	881	30
5° 0	1°058	1°051	1°044	1°037	1°030	1°023	1°016	1°009	1°001	994	987	979	5° 0
30	1°163	1°156	1°148	1°140	1°133	1°125	1°117	1°109	1°101	1°093	1°085	1°077	30
6° 0	1°268	1°260	1°252	1°244	1°236	1°227	1°219	1°210	1°201	1°192	1°183	1°174	6° 0
30	1°374	1°365	1°356	1°347	1°338	1°329	1°320	1°310	1°301	1°291	1°282	1°272	30
7° 0	1°479	1°469	1°460	1°450	1°441	1°431	1°421	1°411	1°400	1°390	1°380	1°369	7° 0
30	1°584	1°574	1°564	1°553	1°543	1°532	1°522	1°511	1°500	1°489	1°478	1°466	30
8° 0	1°689	1°678	1°667	1°656	1°645	1°634	1°622	1°611	1°599	1°587	1°576	1°564	8° 0
30	1°794	1°782	1°771	1°759	1°747	1°735	1°723	1°711	1°698	1°686	1°673	1°661	30
9° 0	1°898	1°886	1°874	1°862	1°849	1°837	1°824	1°811	1°798	1°784	1°771	1°757	9° 0
30	2°003	1°990	1°977	1°964	1°951	1°938	1°924	1°910	1°897	1°883	1°868	1°854	30
10° 0	2°107	2°094	2°080	2°066	2°053	2°038	2°024	2°010	1°995	1°981	1°966	1°951	10° 0

Azimuth	LATITUDE.												Azimuth
	42° 0'	42° 30'	43° 0'	43° 30'	44° 0'	44° 30'	45° 0'	45° 30'	46° 0'	46° 30'	47° 0'	47° 30'	
0° 0	0° 097	0° 097	0° 096	0° 095	0° 094	0° 094	0° 092	0° 092	0° 091	0° 090	0° 089	0° 088	0° 30
1° 0	1° 194	1° 193	1° 192	1° 190	1° 188	1° 187	1° 185	1° 184	1° 182	1° 180	1° 179	1° 177	1° 0
30	2°292	2°290	2°287	2°285	2°283	2°280	2°278	2°275	2°273	2°270	2°268	2°265	30
2° 0	3°389	3°386	3°383	3°380	3°377	3°373	3°370	3°367	3°364	3°360	3°357	3°354	2° 0
30	4°486	4°482	4°479	4°475	4°471	4°467	4°463	4°459	4°455	4°450	4°446	4°442	30
3° 0	5°583	5°579	5°574	5°569	5°565	5°560	5°555	5°550	5°545	5°540	5°535	5°530	3° 0
30	6°681	6°675	6°670	6°664	6°659	6°653	6°648	6°642	6°636	6°630	6°625	6°619	30
4° 0	7°778	7°771	7°765	7°759	7°753	7°746	7°740	7°733	7°727	7°720	7°714	7°707	4° 0
30	8°875	8°868	8°861	8°854	8°847	8°839	8°832	8°825	8°818	8°810	8°803	8°795	30
5° 0	9°972	9°964	9°956	9°948	9°940	9°933	9°924	9°916	9°908	9°900	9°892	9°883	5° 0
30	1°068	1°060	1°051	1°043	1°034	1°025	1°017	1°008	1°999	1°990	1°981	1°971	30
6° 0	1°165	1°156	1°147	1°137	1°128	1°118	1°109	1°109	1°089	1°079	1°069	1°059	6° 0
30	1°262	1°252	1°242	1°232	1°221	1°211	1°201	1°190	1°180	1°169	1°158	1°147	30
7° 0	1°358	1°348	1°337	1°326	1°315	1°304	1°293	1°281	1°270	1°258	1°247	1°235	7° 0
30	1°455	1°444	1°432	1°420	1°408	1°396	1°384	1°372	1°360	1°348	1°335	1°323	30
8° 0	1°551	1°539	1°527	1°514	1°502	1°489	1°476	1°463	1°450	1°437	1°424	1°410	8° 0
30	1°648	1°635	1°622	1°608	1°595	1°581	1°568	1°554	1°540	1°526	1°512	1°498	30
9° 0	1°744	1°730	1°716	1°702	1°688	1°674	1°659	1°645	1°630	1°615	1°600	1°586	9° 0
30	1°840	1°825	1°811	1°796	1°781	1°766	1°751	1°735	1°720	1°704	1°688	1°673	30
10° 0	1°936	1°920	1°905	1°889	1°874	1°858	1°842	1°826	1°809	1°792	1°776	1°760	10° 0

TABLE IV.—Continued.

RATE OF CHANGE OF ALTITUDE PER MINUTE OF TIME.

LATITUDE.														Azimuth
48° 0'	48° 30'	49° 0'	49° 30'	50° 0'	50° 30'	51° 0'	51° 30'	52° 0'	52° 30'	53° 0'	53° 30'			
0° 30'	.088	.087	.086	.085	.084	.083	.082	.081	.081	.080	.079	.078	0° 30'	
1° 0	.175	.174	.172	.170	.168	.167	.165	.163	.161	.159	.158	.156	1° 0	
30	.263	.260	.258	.255	.252	.250	.247	.244	.242	.239	.236	.234	30	
2° 0	.350	.347	.343	.340	.337	.333	.329	.326	.323	.319	.315	.311	2° 0	
30	.438	.434	.429	.425	.421	.416	.412	.407	.403	.398	.394	.389	30	
3° 0	.525	.520	.515	.510	.505	.499	.494	.489	.483	.478	.472	.467	3° 0	
30	.613	.607	.601	.595	.589	.583	.576	.570	.564	.558	.551	.545	30	
4° 0	.700	.693	.687	.680	.673	.666	.659	.651	.644	.637	.630	.622	4° 0	
30	.788	.780	.772	.764	.757	.749	.741	.733	.725	.717	.708	.700	30	
5° 0	.875	.866	.858	.849	.840	.832	.823	.814	.805	.796	.787	.778	5° 0	
30	.962	.953	.943	.934	.924	.915	.905	.895	.885	.875	.865	.855	30	
6° 0	1.049	1.039	1.028	1.018	1.008	.997	.987	.976	.965	.955	.944	.933	6° 0	
30	1.136	1.125	1.114	1.103	1.091	1.060	1.069	1.057	1.045	1.034	1.022	1.010	30	
7° 0	1.223	1.211	1.199	1.187	1.175	1.163	1.150	1.138	1.125	1.113	1.100	1.087	7° 0	
30	1.310	1.297	1.284	1.272	1.259	1.245	1.232	1.219	1.205	1.192	1.178	1.165	30	
8° 0	1.397	1.383	1.370	1.356	1.342	1.328	1.314	1.300	1.285	1.271	1.256	1.242	8° 0	
30	1.484	1.469	1.455	1.440	1.425	1.410	1.395	1.380	1.365	1.350	1.334	1.319	30	
9° 0	1.570	1.555	1.539	1.524	1.503	1.493	1.477	1.461	1.445	1.428	1.412	1.396	9° 0	
30	1.657	1.640	1.624	1.608	1.591	1.573	1.558	1.541	1.524	1.507	1.490	1.473	30	
10° 0	1.743	1.726	1.709	1.692	1.674	1.657	1.639	1.621	1.603	1.586	1.568	1.549	10° 0	
LATITUDE.														Azimuth
54° 0'	54° 30'	55° 0'	55° 30'	56° 0'	56° 30'	57° 0'	57° 30'	58° 0'	58° 30'	59° 0'	59° 30'	60° 0'		
0° 30'	.077	.076	.075	.074	.073	.072	.071	.070	.069	.068	.067	.066	.065	0° 30'
1° 0	.154	.152	.150	.148	.146	.145	.143	.141	.139	.137	.135	.133	.131	1° 0
30	.231	.228	.225	.222	.220	.217	.214	.211	.208	.205	.202	.199	.196	30
2° 0	.308	.304	.300	.297	.293	.289	.285	.281	.277	.274	.270	.266	.262	2° 0
30	.385	.380	.375	.371	.366	.361	.356	.352	.347	.342	.337	.332	.327	30
3° 0	.461	.456	.450	.445	.439	.433	.428	.422	.416	.410	.404	.398	.393	3° 0
30	.538	.532	.525	.519	.512	.505	.499	.492	.485	.479	.472	.465	.458	30
4° 0	.615	.608	.600	.593	.585	.578	.570	.562	.555	.547	.539	.531	.523	4° 0
30	.692	.683	.675	.667	.658	.650	.641	.632	.624	.615	.606	.597	.588	30
5° 0	.768	.759	.750	.741	.731	.722	.712	.702	.693	.683	.673	.664	.654	5° 0
30	.845	.835	.825	.814	.804	.794	.783	.773	.762	.751	.741	.730	.719	30
6° 0	.922	.911	.899	.888	.877	.865	.854	.843	.831	.819	.808	.796	.784	6° 0
30	.998	.986	.974	.962	.950	.937	.926	.912	.900	.887	.875	.862	.849	30
7° 0	1.074	1.062	1.049	1.035	1.022	1.009	.996	.982	.969	.955	.942	.928	.914	7° 0
30	1.151	1.137	1.123	1.109	1.095	1.081	1.066	1.052	1.038	1.023	1.008	.994	.979	30
8° 0	1.227	1.212	1.197	1.182	1.167	1.152	1.137	1.122	1.106	1.091	1.075	1.059	1.044	8° 0
30	1.303	1.288	1.272	1.256	1.240	1.224	1.208	1.191	1.175	1.158	1.142	1.125	1.109	30
9° 0	1.379	1.363	1.346	1.329	1.312	1.295	1.278	1.261	1.243	1.226	1.209	1.191	1.173	9° 0
30	1.455	1.438	1.420	1.402	1.384	1.366	1.348	1.330	1.312	1.294	1.275	1.257	1.238	30
10° 0	1.531	1.513	1.494	1.475	1.457	1.438	1.419	1.400	1.380	1.361	1.342	1.322	1.302	10° 0

TABLE V. (A.)

FOR CONVERTING MINUTES AND SECONDS OF ARC TO THE DECIMAL OF A DEGREE.

Arc.	Decimal of Degree.	Arc.	Decimal of Degree.	Arc.	Decimal of Degree.	Arc.	Decimal of Degree.	Arc.	Decimal of Degree.	Arc.	Decimal of Degree.
0 30	.008	10 30	.175	20 30	.342	30 30	.508	40 30	.675	50 30	.842
1 0	.017	11 0	.183	21 0	.350	31 0	.517	41 0	.683	51 0	.850
30	.025	30	.192	30	.358	30	.525	30	.692	30	.858
2 0	.033	12 0	.200	22 0	.367	32 0	.533	42 0	.700	52 0	.867
30	.042	30	.208	30	.375	30	.542	30	.708	30	.875
3 0	.050	13 0	.217	23 0	.383	33 0	.550	43 0	.717	53 0	.883
30	.058	30	.225	30	.392	30	.558	30	.725	30	.892
4 0	.067	14 0	.233	24 0	.400	34 0	.567	44 0	.733	54 0	.900
30	.075	30	.242	30	.408	30	.575	30	.742	30	.908
5 0	.083	15 0	.250	25 0	.417	35 0	.583	45 0	.750	55 0	.917
30	.092	30	.258	30	.425	30	.592	30	.758	30	.925
6 0	.100	16 0	.267	26 0	.433	36 0	.600	46 0	.767	56 0	.933
30	.108	30	.275	30	.442	30	.608	30	.775	30	.942
7 0	.117	17 0	.283	27 0	.450	37 0	.617	47 0	.783	57 0	.950
30	.125	30	.292	30	.458	30	.625	30	.792	30	.958
8 0	.133	18 0	.300	28 0	.467	38 0	.633	48 0	.800	58 0	.967
30	.142	30	.308	30	.475	30	.642	30	.808	30	.975
9 0	.150	19 0	.317	29 0	.483	39 0	.650	49 0	.817	59 0	.983
30	.158	30	.325	30	.492	30	.658	30	.825	30	.992
10 0	.167	20 0	.333	30 0	.500	40 0	.667	50 0	.833		

TABLE V. (B.)

FOR CONVERTING SECONDS OF TIME TO THE DECIMAL OF A MINUTE OF TIME.

Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.
1	.017	11	.183	21	.350	31	.517	41	.683	51	.850
2	.033	12	.200	22	.367	32	.533	42	.700	52	.867
3	.050	13	.217	23	.383	33	.550	43	.717	53	.883
4	.067	14	.233	24	.400	34	.567	44	.733	54	.900
5	.083	15	.250	25	.417	35	.583	45	.750	55	.917
6	.100	16	.267	26	.433	36	.600	46	.767	56	.933
7	.117	17	.283	27	.450	37	.617	47	.783	57	.950
8	.133	18	.300	28	.467	38	.633	48	.800	58	.967
9	.150	19	.317	29	.483	39	.650	49	.817	59	.983
10	.167	20	.333	30	.500	40	.667	50	.833		

APPENDIX.

Proofs of Formulae Employed.

It has been thought advisable to keep the purely theoretical portion of this work separate from the general body of the book. The demonstrations which follow will, it is hoped, suffice to make clear the principles upon which the construction of the Tables depends.

In the triangle PZX , when z, z' are the Zenith Distances of a given heavenly body, we have by Taylor's Theorem the formula—

$$z = z' + \frac{dz}{dh} (\Delta h) + \frac{1}{2} \frac{d^2 z}{dh^2} (\Delta h)^2 + \frac{1}{4} \frac{d^3 z}{dh^3} (\Delta h)^3 + \dots$$

It is required to deduce from this that when the angle PZX is nearly right, i.e., when the body is near the Prime Vertical

$$z - z' = \cos l (15t) - \frac{1}{2} \sin^2 l \cos l \sin^2 l (15t)^3 + \dots$$

It will be convenient to first find geometrically values for the co-efficients $\frac{dz}{dh}, \frac{d^2 z}{dh^2}$, when p, c , two sides of the triangle of reference PZX , are regarded as constant.

Let X be the position of a body observed, X' its position in the diurnal path a little earlier.

With centre Z , and the arc ZX' as radius, describe the arc of a small circle $X'm$, so that $Xm = ZX - ZX'$, and the angle XmX' is a right angle.

In the small triangle XmX' so formed, which being small may be regarded as plane—

$$\begin{aligned} Xm &= XX' \cos mXX' \\ \text{or } dz &= dh \cos d \cos mXX' \\ &= dh \cos d \sin PZX. \\ &= dh \cos l \sin PZX. \end{aligned}$$

Thus $\frac{dz}{dh} = \cos l$, when $PZX = 90^\circ$ (approximately).

Similarly in the same triangle—

$$X'm = dZ \sin z = XX' \sin mXX' = dh \cos d \cos PZX$$

$$\text{Whence } \frac{dZ}{dh} = - \frac{\cos d \cos PZX}{\sin z} = - \sin l, \text{ if } PZX = 90^\circ.$$

The negative sign being necessary since PZX decreases as ZPX increases.

To obtain $\frac{d^2 z}{dh^2}$

From the general formula obtained above

$$\frac{dz}{dh} = \cos l \sin PZX$$

$$\text{Differentiating } \frac{d^2 z}{dh^2} = \cos l \cos PZX \frac{dZ}{dh}$$

$$= - \frac{\cos l \cos d \cos PZX \cos PZX}{\sin z} = 0, \text{ if } PZX = 90^\circ.$$

To obtain $\frac{d^3 z}{dh^3}$.

From the general formula

$$\frac{d^2 z}{dh^2} = - \frac{\cos l \cos d \cos PZX \cos PXZ}{\sin z}$$

Differentiating, and retaining only terms which do not vanish when $PZX = 90^\circ$

$$\begin{aligned} \frac{d^3 z}{dh^3} &= \frac{\cos l \cos d \cos PXZ \sin PZX}{\sin z} \frac{dz}{dh} \\ &= - \frac{\cos l \cos d \cos PXZ \sin l}{\sin z}. \end{aligned}$$

But if PZX is 90° $\cos PXZ = \tan d \tan z$.

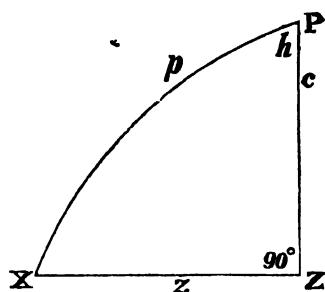
Substituting this value, and reducing, we have $\frac{d^3 z}{dh^3} = -\cos l \sin^2 l$.

Thus in the original expression

$$\begin{aligned} z - z' &= \frac{dz}{dh} (\Delta h) + \frac{1}{2} \frac{d^2 z}{dh^2} (\Delta h)^2 \\ &\quad + \frac{1}{6} \frac{d^3 z}{dh^3} (\Delta h)^3 + \dots \end{aligned}$$

we have, when PZX is 90°

$$\begin{aligned} \frac{dz}{dh} &= \cos l \\ \frac{d^2 z}{dh^2} &= 0 \\ \frac{d^3 z}{dh^3} &= -\cos l \sin^2 l \end{aligned}$$



And if the interval of time between the Zenith Distances z and z' be t minutes of time, or $15t$ minutes of arc, we get eventually

$$z - z' = \cos l (15t) - \frac{1}{6} \cos l \sin^2 l \sin^2 1' (15t)^3 + \dots$$

Adaptation of Formula to Case of Maximum Azimuth.

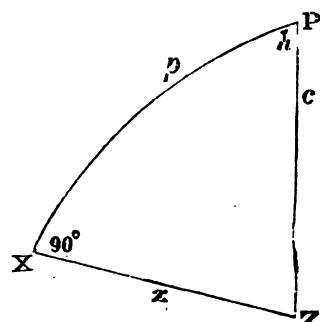
The expression for difference of Zenith Distance when the angle PZX is 90° , may easily be deduced from the formula established above.

For in this instance also p, c are constant, but the right angle is at X , instead of at Z .

It follows therefore by analogy that

$$z - z' = \cos d (15t) - \frac{1}{6} \cos d \sin^2 d \sin^2 1' (15t)^3 + \dots$$

The same form of Tables will therefore be available, d being made use of as argument instead of l .



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